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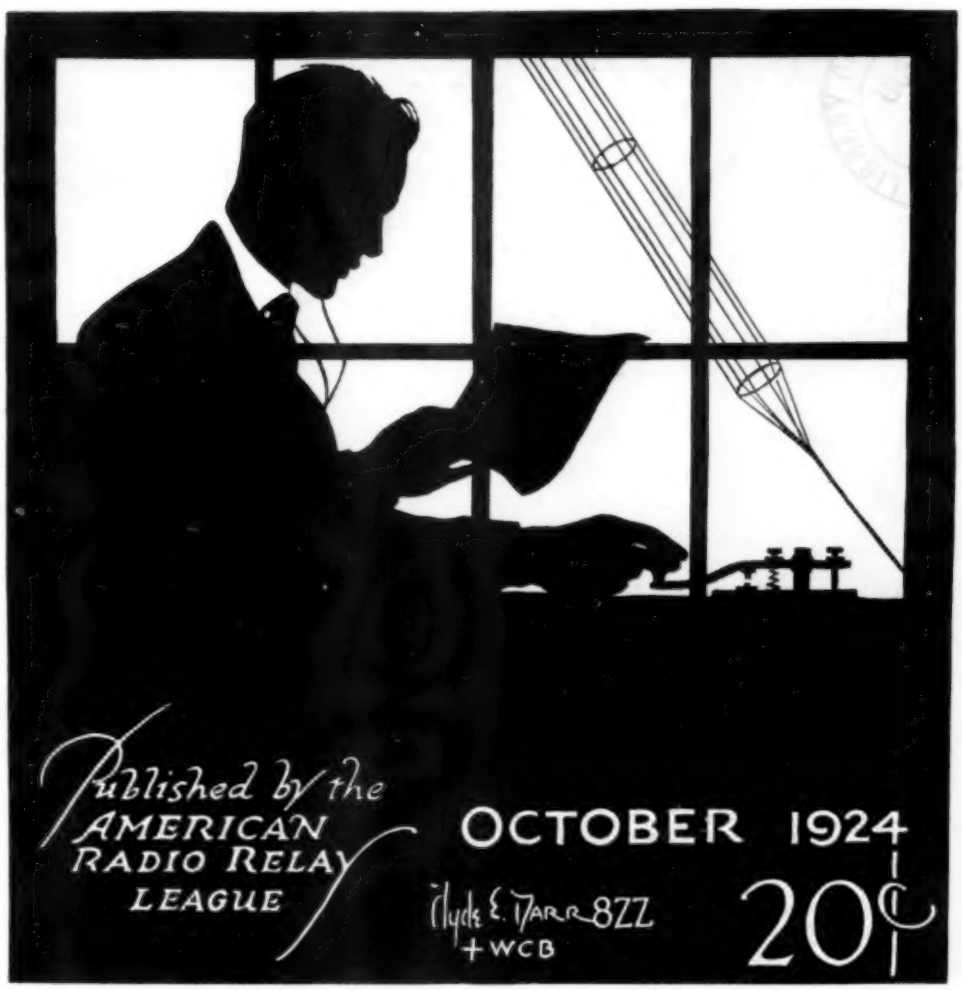

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OCTOBER 1924

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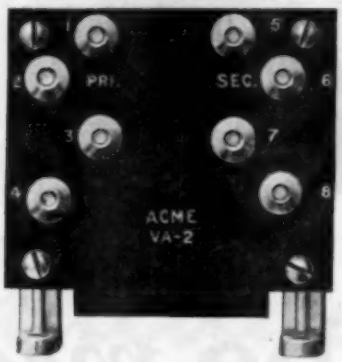

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4:1	1-3	5-7
4.25:1	1-3	5-8
4.75:1	1-2	5-7
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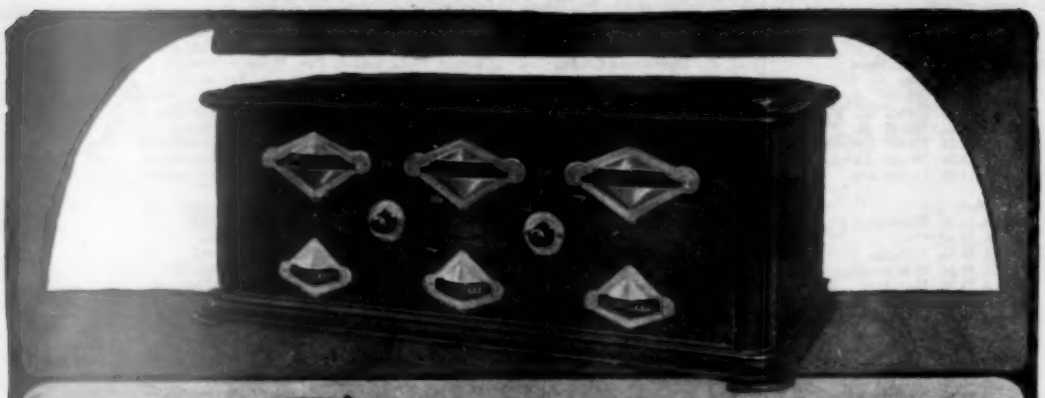

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QST

The Official Organ of the A.R.R.L.

VOLUME VIII OCTOBER, 1924 No. 3

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THE AMERICAN RADIO RELAY LEAGUE, Inc.
HARTFORD, CONN.

THE AMERICAN RADIO RELAY LEAGUE

The American Radio Relay League, Inc., is a national non-commercial association of radio amateurs, bonded for the more effective relaying of friendly messages between their stations, for legislative protection, for orderly operating, and for the practical improvement of short-wave two-way radio telegraphic communication.

It is an incorporated association without capital stock, chartered under the laws of Connecticut. Its affairs are governed by a board of Directors, elected every two years by the general membership. The officers are elected or appointed by the Directors. The League is non-commercial and no one commercially engaged in the manufacture, sale or rental of radio apparatus is eligible to membership on its Board.

"Of, by and for the amateur," it numbers within its ranks practically every worth-while amateur in America and has a history of glorious achievement as the standard bearer in amateur affairs.

Inquiries regarding membership are solicited. Ownership of a transmitting station, while very desirable, is not a prerequisite to membership; a bona-fide interest in amateur radio is the only essential. Correspondence should be addressed to the Secretary.

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EDITORIALS
de AMERICAN RADIO RELAY LEAGUE

The Third Hoover Conference

SECRETARY of Commerce Hoover has called together what is known as the "Third National Radio Conference for the Better Voluntary Regulation of Radio," to convene in Washington on September 30th. The various radio groups have been asked to name representatives, who will then constitute a formal advisory committee to hold public hearings and investigate technical radio problems, making recommendations to the Department which the latter may put into effect if they are within the powers of the Secretary, or which may be used as a basis for voluntary agreement amongst the interests affected if they exceed the authority of the Secretary.

As to be expected, broadcasting occupies the center of the stage. Revision of the present wavelength allocations, limitation of power, division of time, and allied subjects related to the reduction of interference will form the main topic of discussion. A very important item to be considered is the use of the shorter waves. From the amateur viewpoint this is by considerable odds the most important piece of business to come before the Conference, and it deserves our serious thought.

Less than a year has elapsed since the world was stirred by our success in bridging the Atlantic with low power on wavelengths in the neighborhood of 100 meters. Since then there has occurred what our British contemporary *Wireless World & Review* calls "the wavelength revolution." Indeed it is nothing short of that; we wonder if our members realize that in the short space of nine months almost every radio enterprise of importance in the world has around 117; Marconi, with his "beam transmission? There are KDKA, WGY and other American broadcasting stations on various waves from 100 down as low as 15 meters; there is the Eiffel Tower transmitting to our members on various waves between 25 and 115; lately the great French stations at St. Assise, UFT, and the famous Nauen station, POZ, have been handling commercial traffic with the new Argentine high-power station, LPZ, on waves between 75 and 95 meters; IDO at Rome is down around 117; Marconi, with his "beam transmission" from Poldhu, is said to have worked voice to South Africa and Australia on 94 meters; in this country high-speed transocean traffic has been heard being retransmitted on about 100 meters, apparently being automatically relayed; there are already about a dozen ordinary limited commercial stations licensed by our Bureau of Navigation for waves between 125 and 147 meters; our Navy's work from NKF is know to all of us; a large corporation is said to be ready to furnish short-wave installations for tugs, yachts and other small craft.

What does all this mean, and what is its effect upon amateurs? As we see it, it means that these waves, formerly regarded as unsuitable for commercial purposes, are now viewed with the greatest interest by every organization concerned with DX transmission, and they are busy collecting data. Apparently their experiments are proving successful, and so we may expect that they will all want to get in on the short waves. We would not be particularly surprised to see so many requests for short waves that, were they all granted, there would straightway be as many services below 150 meters as there are today between 200 and 20,000!

Well, we started something, anyway. Where do we get off now? Apparently there are going to be some folks who do not like the assignment to the American amateur by the 1912 radio law of all of the waves below 200 meters. Fortunately there is an enormous number of kilocycles in that region, with room enough, probably, for everybody that has to be accomodated. We suspect, tho, that the recent assignments of short-wave bands to us amateurs will be scrutinized at this Conference. We believe ourselves that those assignments must be regarded as modest enough, especially under the existing law which sets no limits on the waves below 200 meters which amateurs may use. We hope that the Conference will be blessed with a spirit of coöperation and reasonableness.

These Advertisers of Ours

WHO pays for *QST?* Our advertisers, of course. That is true of almost every magazine, and particularly of ours. We believe we've mentioned it before, but there is a new angle to the subject that we ought to lay before you now.

Since radio became a great public plaything, supply stores exist in every community, and whereas in ye olden dayes every one of us hams outside of the biggest cities had to get his stuff by mail from the advertisers, it is becoming easy to drop downtown and pick it up from the nearest store. This is much more convenient, of course, but it has an adverse effect on the showing

A.R.R.L. members make with *QST*'s advertisers. Headquarters feels that it can talk quite frankly with you fellows about this subject, because our *QST* is so vastly different from any other radio magazine. *QST* has no owners except us League members; where another magazine has to tread lightly in urging patronage of its advertisers, lest it give offence, there is no reason why we hams should have to beat around the bush.

Frankly, the local radio stores that do not advertise in *QST* are doing nothing to make our *QST* exist; the folks who spend their good fish with us are doing so. We have to show results for them, or they will stop spending, and then we will have no *QST*. Of course many advertisers want us to buy their products from the local stores, but many of them are willing to supply us direct, and it is about the latter that we are particularly talking. Here's the dope: whenever the stuff doesn't have to be had immediately, why not order it direct from the *QST* advertiser and thereby help those who help us? League members can expect good service from *QST*'s advertisers—it will pay big dividends all around.

Oh, yes—don't forget to mention *QST*.

Transocean Working

THE coming of September has always marked the beginning of the big season for the North American ham. Hence we should be well under weigh when these lines appear in print. All signs point to a thrilling winter. Last winter we smashed every ham record for DX, miles-per-watt, and speed. This season we daresay we'll hang up an entirely new bunch.

We have a little obligation to the amateurs of Australia and New Zealand which we'd like to talk about for a moment. The Anzacs have been listening to us for a couple of years now, and a few of their stations have been heard over here. They are most anxious to connect up with us and we ought to make a more determined effort to this end ourselves. Right now is the time, for it must be remembered that they are in the southern hemisphere, with their summer rapidly approaching, and in a few weeks QRN will be hampering their DX reception. Now is the best time of the year—while it is fall with us and spring with them. The wavelengths are all around, but 110 to 130 seems the best bet. We urge our members, particularly the fellows west of the Rockies, to keep a sharp watch for the "a" and "z" intermediates, and to lose no chance to tie up with that Boomerang.

Eastward things are looking up decidedly. Many new European countries are on the air and we are assured of an army of amateurs anxious to work with us. In Great Britain it seems that the prohibition of international operation which for some weeks was giving British amateurs much concern was due to an unfortunate choice of words by the G.P.O. and that there was no intent to change the existing regulation respecting such operation, so we may expect the Britons in numbers.

It wouldn't take an awful amount of luck to make the Amateur 'Round-the-World Relay a reality this winter!

A Caution

THERE is danger, now that we have a variety of wave-band allocations, that we may split into a number of families, each inhabiting one of those bands and knowing nothing of the others. Until we discover some simple method of working anywhere at will, most of us will not succeed in making our transmitters work efficiently on more than two of the amateur bands, and most of us cannot afford a multiplicity of complete transmitters. The tendency, then, will be for some of us to become isolated on certain bands and others of us on other bands.

We must avoid that. The easiest way is for every one of us to have a receiving set that will cover all the amateur bands and make it a regular practice to listen in on each band. In that way we can keep in touch with each other, see what the other fellow is doing, and find out what bands we are most interested in ourselves. Then we can visit around, etherically speaking, and continue one big family.

Notice to Our Newsstand Readers

As announced in recent issues, The Traffic Department Report and the "Calls Heard" Department have been eliminated from the newsstand edition of *QST* because our non-member readers in general are not particularly interested in them. This results in a saving in expense which makes possible the publication of a larger and better *QST*.

These two departments are included in the edition supplied to members of the A.R.R.L. If you are interested in them, it is proof positive that you ought to be a member of the League. May we not direct you to the handy application blank appearing on page 96 of this issue?

The Standard-Frequency Set at WWV*

By Hoy J. Walis†

Probably no radio station has ever rendered the American radio world so great a service as that of WWV in transmitting the standard wave signals. Before these signals began both broadcast and amateur waves were uncertain and often wavemeters disagreed violently. Since the signals began those in the East have been able to make precision calibration on their own wavemeters and to pass the information on into the West.

WWV is here described by the man who has been most active in furthering the progress of this service.

DURING the past year the Bureau of Standards has been transmitting standard frequency signals from station WWV over a frequency range from 125 to 2000 kilocycles. These signals have been received with enthusiasm by all classes of radio operators. The frequencies from 125 to 500 kilocycles have proven useful to operators of Government, commercial and ship stations. Frequencies from 500 to 1,300 kilocycles have assisted materially in keeping the broadcasting stations on their assigned frequencies and the frequencies from 1300 to 2000 kilocycles have enabled the amateurs to keep within their bounds. The purpose of this article is to describe the apparatus used at the Bureau of Standards for transmitting these signals.

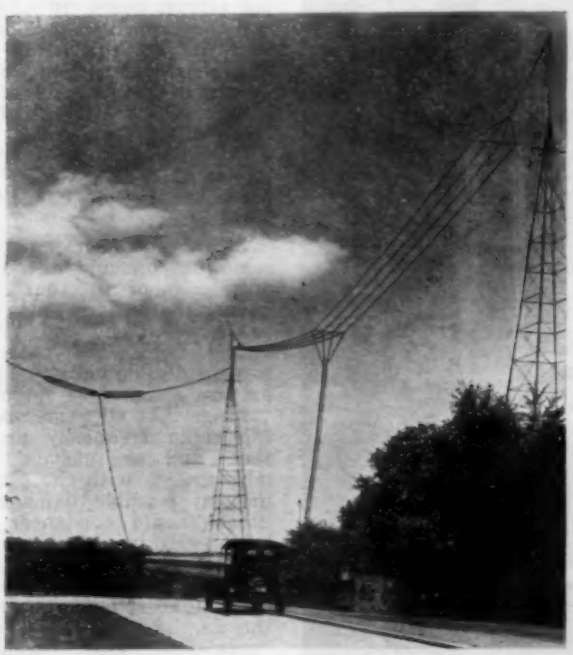


Fig. 2

A Radiating System That Would Make Almost Any Ham Jealous. WWV Uses The Large Antenna for Transmitting The Longer Waves of Their Standard Wave Transmissions and the Small Antenna for the Short Waves.

The transmitting set is a 1-K.W. continuous wave set of the "master-oscillator power-amplifier" type especially designed to operate over a wide range of frequencies and to permit rapid change from one frequency to another. A photograph of the set is given in Fig. 1. On the upper shelf is mounted the master-oscillator, modulator and speech amplifier tubes and their associated tuning and other apparatus. On the bottom of this shelf on the left side of the frame is mounted the variable condenser that is used in coupling the master-oscillator to the grids of the amplifier tubes. The next shelf carries the amplifier tubes with their separate plate fuses and grid choke coils. Under these tubes on the next shelf are mounted the antenna tuning condensers and one of the antenna inductors. The bottom shelf holds the filament lighting transformer, amplifier grid battery, the modulator and speech amplifier grid batteries. On the floor directly under the set is a large condenser which is used in the antenna circuit, between the set and the ground, to prevent grounding the direct-current high voltage supply when the ground connection is used. The two large inductors in the rear of the set are used to load the antenna circuit when transmitting on the low frequencies and the small spiral inductor is used as the antenna inductance for the extremely high frequencies. On the panel are mounted all the tuning controls and indicating instruments except the antenna ammeter which is mounted on the rear of the frame.

*Published by permission of the Director of the Bureau of Standards.

†Assistant Physcist, Bureau of Standards.

The general arrangement of the antennas used is shown in Fig. 2. The large flat top T antenna which is supported between the two towers is approximately 120 feet high and 200 feet long, and is insulated with molded composition insulators. Its natural frequency is approximately 750 kilocycles. The smaller T cage antenna which is supported between one of the towers and a mast on an adjacent building is 90 feet high and 80 feet long and is insulated at each end with five 4-inch porcelain insulators in series. The horizontal portion is a 6-wire cage, 24 inches in diameter, and the down-lead is a 4-wire cage 4 inches in diameter. Its natural frequency

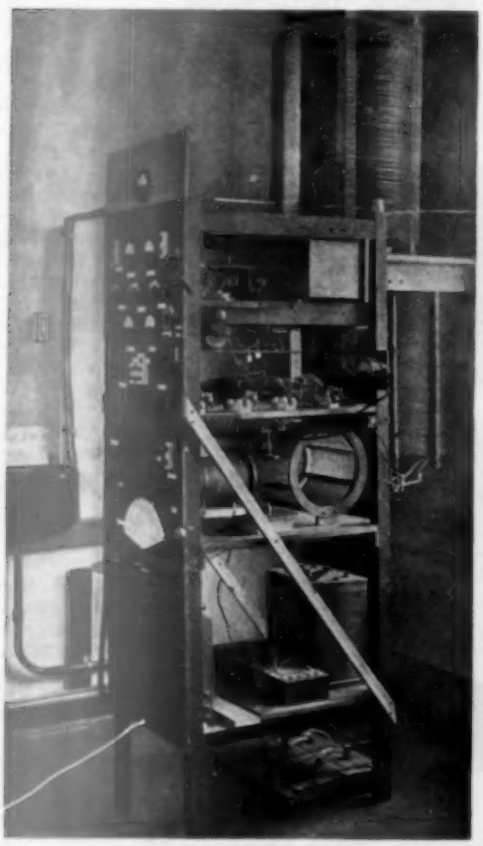


Fig. 1

The 1-KW. Master-Oscillator Power-Amplifier Set At WVV by Which Many Amateur Wavemeters Have Been Calibrated.

when used with the counterpoise is approximately 1325 kilocycles. The counterpoise is about 10 feet above the ground and directly under the small cage antenna. It is made of six wires 120 feet long and spaced six feet apart. It is supported at six points and is insulated with porcelain insulators. The two antenna leads and the counterpoise lead are brought into the operating room through holes in a plate glass window. A ground connection consisting of approximately 1000 feet of No. 4 copper wire buried six inches in the ground directly under the small antenna in a rectangle approximately 150 feet long and 50 feet wide is also available.

When transmitting on frequencies from 150 to 300 kilocycles the large antenna is used together with the counterpoise and ground connected in parallel. No attempt is made to tune the counterpoise when used with the ground connection. For frequencies from 400 to 2000 kilocycles the small cage antenna is used with the counterpoise, in which case the latter becomes a part of the tuned antenna circuit.

The circuit diagram of the transmitting set is given in Fig. 3. The master-oscillator which is shown in the center of the diagram employs a 50-watt tube in a Hartley circuit made up of the inductance L_1 and the capacity C_1. The indicator L_1 consists of 30 turns of ¼ inch edgewise wound copper ribbon on a form 9 inches long and 12 inches in diameter. The condenser C_1 has a capacity of 0.0003 mf and is used for frequencies from 250 to 2000 kilocycles. To obtain lower frequencies it is necessary to parallel C_1 with two fixed condensers whose capacities are 0.002 and 0.004 mf.

Series feed is employed in a manner somewhat unusual in a Hartley circuit but quite common in other circuits. By introducing the plate voltage across a condenser in the filament tap the radio-frequency voltage across the choke coil L_2 is reduced to a negligible value. This method as well as any series feed method has the disadvantage that all parts are "alive" with both the radio frequency and the direct currents, and care must be taken while making adjustments with the plate voltage on. To prevent possible damage to the amplifier tubes should condenser C_3 flash over, a large well insulated condenser (about 2.3 μf) is put in series with condenser C_3 to prevent the direct current from the master-oscillator from reaching the grids of the amplifier tubes. The filaments of the "master-oscillator," modulator, and speech amplifier tubes are lighted by direct current from a 21-volt, 12-ampere storage battery.

The power amplifier consists of four 250-watt tubes connected in parallel. Radio-frequency voltage from the master-oscillator circuit L_4C_4 is fed through the condenser C_3 directly to the grids of these tubes. Small choke coils L_4 are used in series with the grids to prevent parasitic oscillations. A negative voltage of about 200 volts is used on the grids of the amplifier tubes. This voltage is obtained

partly from dry batteries and partly from the voltage drop across the resistance R_4 in the plate circuit. The use of such high negative voltage on the grids of amplifier tubes causes considerable distortion in the amplifier plate current which results in higher total efficiency but increases the intensity of the harmonics in somewhat greater proportion than it does the output on the fundamental frequency. The amplifiers feed directly into the antenna circuit consisting of the inductors L_8 and L_9 and the condensers C_9 and C_{10}. For frequencies from 1000 to 2000 kc the small spiral inductors mounted on the rear of the transmitting set and the variable condenser C_{10} are used above the natural frequency of the antenna. For frequencies from 400 to 1000 kc the inductor mounted in the transmitting set frame is used and fine adjustment is secured by means of the variable inductor L_9 which is mounted back of the antenna ammeter. A single-pole double-throw switch is provided for placing either the variable inductor L_9 or the variable condenser C_{10} in the antenna circuit. For still lower frequencies the inductors mounted on the wall in the rear of the set are connected in the antenna circuit as loading coils. Series plate feed is employed in the amplifier for much the same reasons as were given in the master-oscillator circuit. The set is keyed by opening the amplifier grid circuit and allowing the amplifier tubes to block. Since the master oscillator circuit is not keyed some current from this circuit passes through capacity between the grids and plates of the amplifier tubes into the antenna. This current causes a weak "back wave" which can be heard for several miles.

For frequencies from 75 to 500 kc, four 250-watt tubes are used in the power amplifier. For frequencies from 500 to 1500, three tubes are used, and from 1500 to 2000 kc, only two tubes are used. On the lower frequencies it is possible to operate four tubes in parallel in the amplifier and obtain outputs corresponding to their ratings, but on the higher frequencies with the circuit arrangement used satisfactory performance is not obtained with more than two amplifier tubes in parallel. In fact the output from two amplifier tubes on frequencies between 1500 and 2000 kilocycles is greater than when three or even four tubes are used.

The high voltage supply to the transmitting set as well as the filament supply are all in grounded iron conduit and hence the capacity between the wires carrying the plate and filament supply to the set and the ground is appreciable. This results in some grounding of the counterpoise through this capacity and introduces considerably more resistance into the antenna circuit. Because of this condition greater output can be obtained on some frequencies by disconnecting the bypass condenser C_8. However if the antenna circuit could be insulated from the set by employing inductive coupling rather than conductive coupling higher efficiency would probably be obtained but it would result in tuning apparatus which for this work would be somewhat cumbersome.

In tuning the transmitting set to any desired frequency the master-oscillator circuit, which has been calibrated and adjusted so that the tube is operating satisfactorily, is set at approximately the desired frequency. The capacity of the coupling condenser C_8 is reduced, the antenna inductance set on the approximate value and low voltage is supplied to the plates of the amplifier tubes. The antenna circuit is then tuned to resonance with the "master-oscillator" circuit by varying either the capacity C_{10} or the inductance L_9 depending on whether the desired frequency is above or below the natural frequency of the antenna. When resonance is reached, it is indicated by a maximum reading of the antenna ammeter A_{11} and a minimum reading of the plate ammeter A_3. The capacity

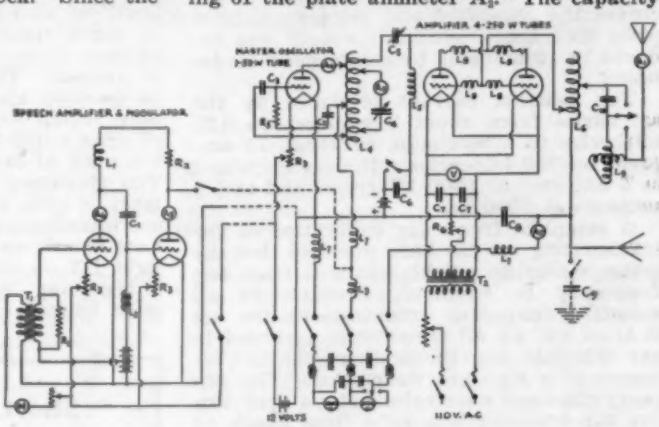


FIG. 3

of the coupling condenser is increased and full voltage applied to the amplifier tubes. The set is then adjusted for maximum output by varying the amplifier plate inductance and the coupling condenser. Fine adjustments are then made in the tuning by means of a small variable condenser in the master-oscillator circuit and by a small variable inductor in the antenna circuit. When large changes are made in frequency

it is necessary to change the capacity of the coupling condenser C_s. On frequencies from 125 to 500 kc a capacity of approximately 0.001 mf is used; for frequencies from 500 to 1000 kc 0.0006 mf is used, and for frequencies from 1000 to 2000 kc the capacity is reduced as the frequency increases from approximately 0.0006 mf to approximately 0.0003 mf. If this capacity is too large an overload is placed on the master-oscillator which may stop that circuit from oscillating and damage the tube if the plate voltage supply is not quickly disconnected. When making adjustments on low power it has been found desirable to reduce the capacity of the coupling condenser C_s to about half the normal value since much more power is drawn from the master-oscillator circuit when low voltage is used on the amplifier plates than when high voltage is used.

When telephony is desired the modulator and speech amplifier shown on the left of Fig. 3 are connected in the circuit by means of two switches, one in the plate circuit and the other in the filament circuit. The modulator is a 50-watt tube similar to the "master oscillator" tube. The speech amplifier is a 5-watt tube. In order to secure good upward modulation the set is first adjusted for maximum output and then the output reduced to one-half. If, for example, it was possible to obtain a maximum output of 20 amperes of "carrier" it would be necessary to decrease the amplifier and master-oscillator plate inductance until this output was reduced to 10 amperes to secure good modulation.

The antenna current produced by the set varies from about 8 amperes on 125 kilocycles to a maximum of about 15 amperes on 700 kilocycles . It then decreases to 7 amperes at 1500 kilocycles and to 1.5 amperes at 2000 kc.

A complete frequency calibration of the transmitting set has been made so that the settings may be quickly changed from one frequency to another. Previous to all standard frequency transmissions the set is tried out on all frequencies included in the schedule and the settings checked by means of a standard wavemeter. The primary standard wavemeter is then used during the transmissions as a final check on the settings. It is quite possible by means of fine adjustment controls to set the transmitting set on the desired frequency and measurements with the wavemeter show that the master oscillator keeps the frequency practically constant during the transmission. The small variations in frequency that are noticed can be traced partly to variations in the filament supply voltage which are at times as much as from 5 to 10 percent. and partly to the swinging of the antenna. While the frequency variations caused by the swinging of the antenna have been considerably reduced by the use of the master oscillator, they are not eliminated entirely because of the slight coupling that exists between the antenna and master oscillator through the amplifier tube capacities.

The distance range of the set has been satisfactory. During the year in which it has been in operation the Bureau has received reports of its reception from all U. S. radio districts, Canada, Cuba, England and Italy. Most of the reports show that the received signal intensity is greater the higher the frequency.

Department of Commerce,
Washington, D. C.

Canadian Amateurs Get Short Waves Too

JUST one month after our Department of Commerce announced the bands of short waves for amateur use, our Canadian General Manager Russell advises that the Canadian amateurs have been assigned the same bands, until further notice. The Canadians are required to use pure C.W. but loose-coupled transmitters are not required nor do they have to make application to use these waves.

There is no question but that some of the hoggish commercial interests will protest these assignments in both our Countries, yet we must insist that we hams have as much right to experiment down there as they have, which is all they are doing at present. The short waves are valuable, no question about that, but we don't think they should become the exclusive property of some selfish commercial interest, at least not until after they know what they want. The frequency bands are such that there must be some room for amateur work without interference with any commercial work. Last month we mentioned some of the daylight DX on short waves and we have seen a big jump in amateur activity since the quiet hours were abolished on short waves.

—*F.H.S.*

Short Wave Daylight Transcons

Attention, Gang! Get set for some Sunday daylight Transcons on short waves. The dates probably will be November 9th and 16th. You have plenty of time to get ready by then, but get lined up for your best daylight DX and be ready on the 75 and 80 meter band. Details next month.

—*F.H.S.*

Working at 5 Meters

By S. Kruse, Technical Editor

LAST month I said that ordinary methods worked perfectly well down to 20 meters but special care was needed below that. Since that time hundreds of stations have been working at 40 and 80 meters, not very many at 20 meters—and very few indeed at 5 meters. Most of the 20 and 5 meter work has failed because of an unsteady wave which could not be read, altho very strong at the receiver. The moral is to make a 5-watt tube work steadily rather than to make a 250-watt tube work unsteadily.

Getting Down

I also advised the use of one tube only. This was correct at 40 meters, is still more important at 20 meters, and it is almost out of the question to make several American tubes work in parallel at 5 meters. The reason for this is the insistence of our tube makers in bringing all terminals out in a bunch at one end of the tube. If they would only bring the plate out somewhere else we would have little trouble. The English and Germans do this, while some French tubes have two separate "horns" on the top, one for the grid and another for the plate.

To get the tube capacity down to something reasonable take off the tube base as described in Fig. 7, page 12, of the September *QST*, then mount the tube *right side up* with asbestos pads to hold it in place but with plenty of room for air cooling.

The next thing is to cut down the inductance in the circuit and the way of doing this is shown in Fig. 1. The Hartley circuit is shown because it is simple. Series feed is used because this is to be a loose-coupled set and therefore no harm will come from series feeding. Shunt feed can be used but there will be more trouble in making the chokes work well.

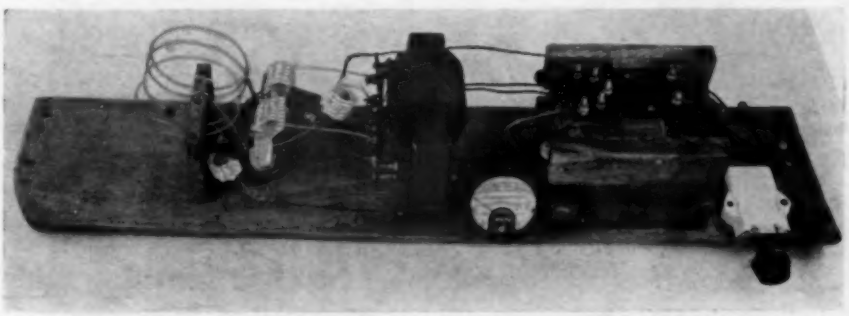
Now we are down to a very small helix, and no capacity except that of the tube—can we make this thing oscillate?

The Circuit

The complete circuit is shown in Fig. 2. A little study will show this to be the same circuit as in Fig. 1, with the addition of the radio frequency chokes needed to make the tube oscillate.

To tell when the set is oscillating the simplest test is to touch the plate coil with a *wood* handled screwdriver. Be careful—the burns from even a 5-watt oscillator are pretty painful.

If the screwdriver does not spark try raising the plate and filament voltage a bit, then try putting the plate and grid turns a bit closer together. If the screwdriver still does not give any results take a look at the R.F. chokes—they are very important.



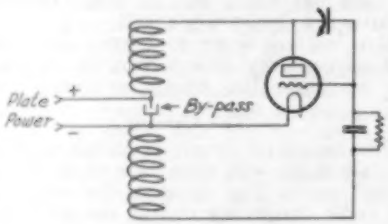
A 5 METER OSCILLATOR SET COMPLETE

At the left is the 3" helix and next to it the baseless C-302 tube with its chokes and condensers. Beyond that is the Acme filament transformer, then a Weston 100-mil. D.C. instrument used to measure the plate current. The plate power is supplied by the home-made transformer at the right. The filament voltage is controlled by the E210 Bradleystat at the right end of he board. This rheostat is connected in the primary circuit of the filament transformer. The circuit is shown in Fig. 2.

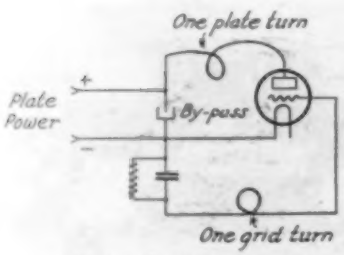
The Chokes

In our 100-200 meter work we have found the best choke to be a single-layer affair 6 inches long and 3 or 4 inches in diameter with a winding of several hundred turns of fine wire. Such a choke does not work well at 5 meters because the distributed capacity per turn is large enough to short-circuit the whole thing. Smaller turns are needed and even then the capacity per turn must be

kept down. In the oscillator shown here the chokes were wound of 30 turns of No. 26 D.C.C. wound Lorenz (basket) fashion on 7 pins set in a ¾" circle. When stripped off the pins these chokes were tied with thread and not "doped" at all. In the filament circuit these were ideal because the length of the wire *must* be kept short to prevent too much of a voltage drop. For



Ordinary Series-feed Hartley



Series-feed Hartley cut down.

FIG. 1

the plate choke, RFC$_4$, this kind of choke may be used but the wire should really be smaller. Pretty fair results will be got from an ordinary porcelain wiring tube wound for 2½" with No. 30 S.C.C. or D.C.C. wire. Of course the porcelain is not exactly all right. An air-core coil of some sort would be better. If you can handle basket-weave coils with No. 30 wire on them you have the real thing; otherwise try making a tiny helix frame of paraffined bristol-board and wind on that—always keeping the diameter small.

The Helix

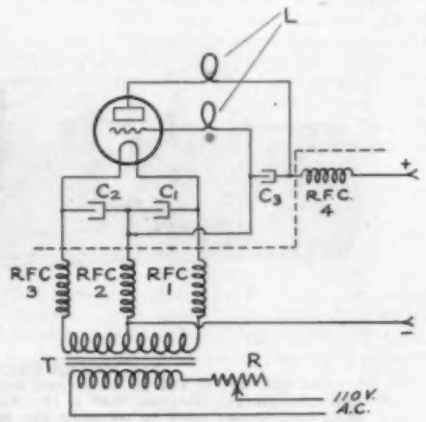
The helix will probably not have over 4 turns altogether and there should be no unused turns as they load up the circuit very much. In the experimental oscillator shown in the photograph the helix was 3" in diameter and had 4 turns of No. 14 wire spaced ½". When working on 5 meters with a C-302 tube the tube connections were made to use one plate turn and two grid turns. This does not seem like much and in fact this oscillator did not operate steadily below 4.9 meters. Larger wire, giving somewhat less inductance for the same length, will help. The oscillator was tuned by simply bending the helix turns to and from each other, the variation being 4.9 to about 6 meters.

All leads should be kept very short—do the old timers among us remember how we used to sweat blood trying to shorten the primary circuit of a 180 meter spark set?

Measuring the Wave

Very well—now we have an oscillator; we are getting R.F. sparks from the plate coil and are pretty sure that the thing really is working—but what is the wave?

That's a hard one. None of our ordinary wavemeters are any good at all—the best of them stop at about 50 meters. If we start to step down by harmonics we are likely to get all balled up because we must step from 80 to 40 and from 40 to 20 and from 20 to 10 and then from 10 to 5—and then we have only *one* point on the wavemeter and it may



5 METER OSCILLATOR CIRCUIT

FIG. 2

L—Helix, 4 turns of No. 14 bare in two sections with C3 connected between them. Diameter of turns 3", spacing ½".
C3—Bypass condenser, mica of 500 micromicrofarad capacity. This condenser was not satisfactory and should be replaced by one shown in Fig. 8.
C1 & C2—Filament bypass condensers. Micadons with capacity of 500 micromicrofarad or more are satisfactory.
T—Filament transformer.
R—Bradleystat, type E210.
RFC—Radio chokes, 30 turns No. 26 D.C.C. wound basket fashion on 7 pins set on ¾" circle.

not be the right one altho we have had to use up a couple of hours getting it.

There *must* be a simpler way.

Very well—there *is* a simpler way! What do you say to resurrecting the old-time "Lecher Wires"? Then we can *measure the wave with a yardstick* and get results that are quite accurate. Incidentally it is

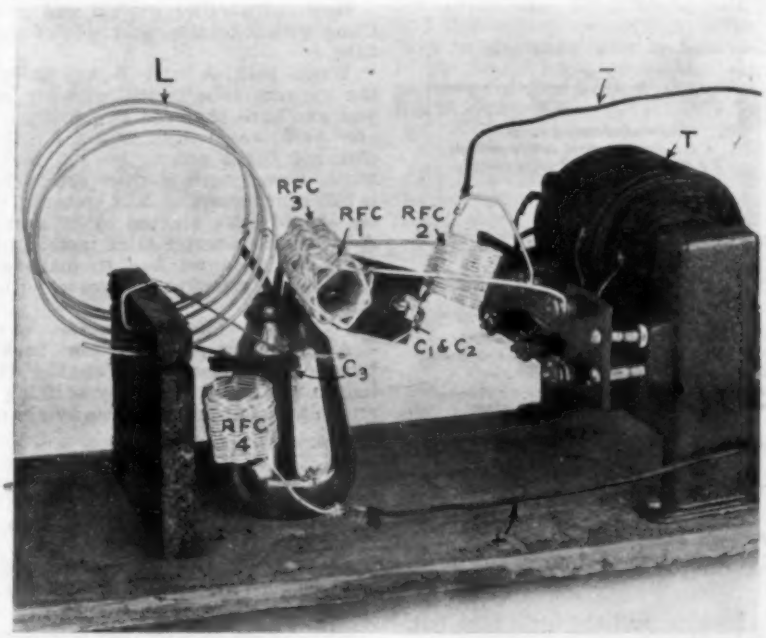
about the most interesting job we have run into for a long time.

The system is explained in Fig. 3. Suppose that you tie a rope to the barn—or the garage—and start shaking the free end up and down. As soon as you have found the right rate for your hand waves start to run along the rope toward the barn as shown in Fig. 3A. As soon as these travelling waves hit they are *reflected* back again and as soon as they have run back to your hand there is set up a system of "standing waves" that does not seem to move at all. This is shown in Fig. 3B.

The same thing can be done in an antenna current at the helix—but little voltage. The same thing is true when working at harmonics—wherever there is current there is little voltage. This is shown by the two wave systems drawn in Fig. 3C.

Notice that there is voltage at the far end of the antenna just as before. This is a general rule—there *cannot* ever be any current at the end of the antenna, therefore we always find voltage there.

If we stick to the *voltages* on our antenna and stop worrying about the currents, things will be much simpler because we have only one wave-system to bother with. Then we can go ahead and measure



DETAIL OF THE OSCILLATOR, SHOWING CHOKES AND CONDENSERS.
See Fig. 2 for meaning of the lettering.
The mica condensers are not satisfactory at 5 meters and should be replaced by air condensers such as those shown in Fig. 8.
Notice the short leads especially.

—in fact we do it every time we send. Generally the antenna has only a quarter-wave on it—current at the bottom and voltage at the end of the top. If we use a counterpoise we have a half-wave, current at the helix and voltage at the ends of both the top and the C.P.

Now if we work the antenna at a harmonic there will be several places in between where voltages will show up as shown in Figure 3B. Notice that the rope showed up only one wave system—an up-and-down motion. The electrical system has *two* wave motions, a voltage wave and a current wave. In the ordinary antenna we have the length of this wave which we have talked about so much without seeming to get the job done.

Let's stop talking and start to do it.

The "Lecher Wires"

Suppose we stretch up a pair of wires as shown in Fig. 3D. You are welcome to look at this as being a one-wire antenna and a one-wire counterpoise close to it. With the oscillator in action this system is tuned by means of the two-plate variable condenser until the little vacuum tube at the far end glows brightly. This tube is taken from a Westinghouse "Spark-C" spark-

plug tester, costing $1.50. Worry the plug out of the upper end of the thing, pull out the crinkled copper sheet, then heat the tip until the wire inside it is unsoldered and the solder can be "flipped" out. Now use

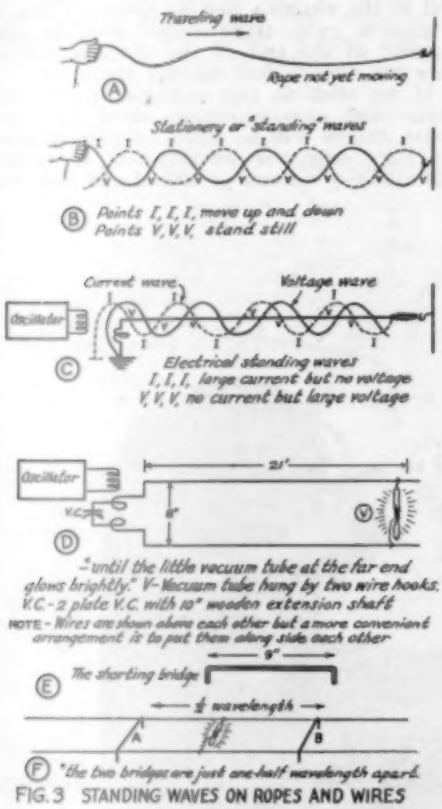

Traveling wave
Rope not yet moving
A
Stationary or "standing" waves
B Points I, I, I, move up and down
Points V, V, V, stand still
Current wave
Voltage wave
Oscillator
C
Electrical standing waves
I, I, I, large current but no voltage
V, V, V, no current but large voltage
Oscillator
21'
V.C.
6"
V
D
"until the little vacuum tube at the far end glows brightly." V-Vacuum tube hung by two wire hooks.
V.C.-2 plate V.C. with 10" wooden extension shaft
NOTE-Wires are shown above each other but a more convenient arrangement is to put them along side each other
9"
E The shorting bridge
½ wavelength
A
B
F "the two bridges are just one-half wavelength apart."

FIG. 3 STANDING WAVES ON ROPES AND WIRES

a stiff wire hook to pull the little tube out, being careful not to break it.

Use the tube as shown on page 26 of September *QST*.

Well—now we are in tune. But are the wires tuned to the oscillator or to 3, or even 5, times the oscillator wave? To find this out slide the vacuum tube along the wires toward the oscillator, pushing it with a folded newspaper and keeping away from the wires as much as possible. Let us hope that the tube goes out soon for then you are tuned to the 3 times, or 5 times wavelength and that is what we want. After the tube goes out keep right on pushing it along slowly—watching carefully until it lights again. Find the place where the tube is brightest and leave it there. Now we are in the middle of a half-wave and the remaining thing is to find the ends of this half-wave. The tube is not good for this so we must use another scheme. Lecher himself devised the plan which was to find the place where a short-circuiting bridge between the two wires made no difference. When such a place is found it is evident that there can be no voltage at that place and we have found the end of the half-wave.

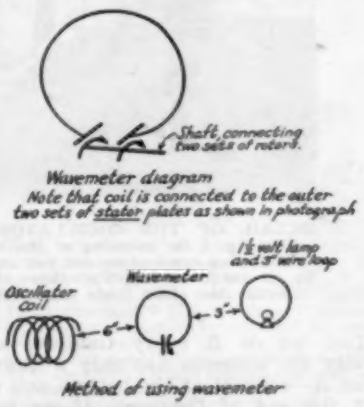
Cut a straight stiff wire 10" long, bend it as in Fig. 3E, lay it across the two wires and start sliding it back and forth until the place is found where the tube will still light. The adjustment can be made within ¼" when working at 5 meters. If the exact place seems uncertain then find the two places where the tube just goes out and set the wire exactly half-way between them. This is the wire A, Fig. 3F.

Now cut another wire B and do the same thing with it on the other side of the vacuum tube.

When both A and B are in place and the vacuum tube is still glowing cheerfully you are sure that the two bridges are just one half wavelength apart. Suppose the distance turns out to be 103 inches. The whole wavelength is then 206 inches which is 523 centimeters or 5.23 meters. Of course we should have started by measuring from A to B with a meter-stick instead of a yard-stick but then we *had* to make good that promise to measure the wave with a *yard*-stick.

The Wavemeter

As we have said further back in this paper, it is possible to change the wavelength of the oscillator by shifting the grid and plate connections, also by changing the


Shaft connecting two sets of rotors.
Wavemeter diagram
Note that coil is connected to the outer two sets of stator plates as shown in photograph
1½ volt lamp and 3" wire loop
Wavemeter
Oscillator coil
6"
3"
Method of using wavemeter

THE 5-METER WAVEMETER
FIG. 4

spacing of the helix. If we leave our 21-foot Lecher wires strung thru the house we will always be able to measure the wave with exactness.

Unfortunately the process isn't very fast and the family is inclined to "grouse" when asked to crawl under the wires to reach the

dining room. We must get this measuring over with—make some sort of a record of it, and then take the wires down.

The easiest way of doing this is to make up a short-wave wavemeter and calibrate it from the Lecher-wire measurements.

The wavemeter is quite a problem. Of course one can remove plates from any of the good low-loss condensers, leaving only a single plate in the rotor and two in the

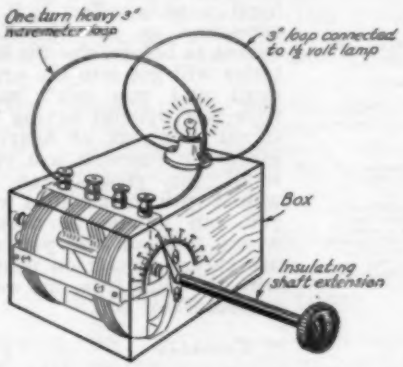


FIG. 5 A 5-METER WAVEMETER

Can also be used for other wavelength ranges by making different condenser connections and using other coils

stator—or the other way around. The trouble with this is that the condenser isn't good for much else afterward.

We turned to the 4-section Bruno condenser. This has all 4 rotor sections connected together but has the stator in 4 parts well insulated from each other. In a receiving circuit, where the shaft is grounded to the filament, this makes it possible to use capacities of 1000, 750, 500 or 250 μμfds. We wanted still lower capacity so we connected the coil to two of the stator sections only, thereby putting two sections in series and giving us a full-scale capacity of 125 μμfds.

Then we got into trouble—for we could not seem to invent a satisfactory indicator to show we had this thing in resonance with the oscillator. The vacuum tube of a flash-lamp was very broad—and our smallest meter was bigger than our wavemeter, which threw the calibration all out of gear.

Then I happened to remember a scheme used at the Bureau of Standards. We didn't have the sensitive meter they use but we got out a substitute that worked wonderfully—and cost just exactly 25¢. The scheme was simply to screw a 1½-volt flashlight lamp (10¢ at Woolworth's) into a small socket and connect the two binding posts of the socket by means of a 3" ring of ordinary No. 18 wire. This thing was untuned, of course. When set 9" from the oscillator this untuned loop shows no life at all. Now if the wavemeter is put between them, as shown in Fig. 4, and then tuned to resonance, the lamp will light very beautifully and the indications will be the sharpest you have ever gotten with a lamp.

In making up a permanent wavemeter the condenser would go inside a box, the wavemeter loop at one side of the box and the lamp loop at the other side, somewhat like Fig. 5.

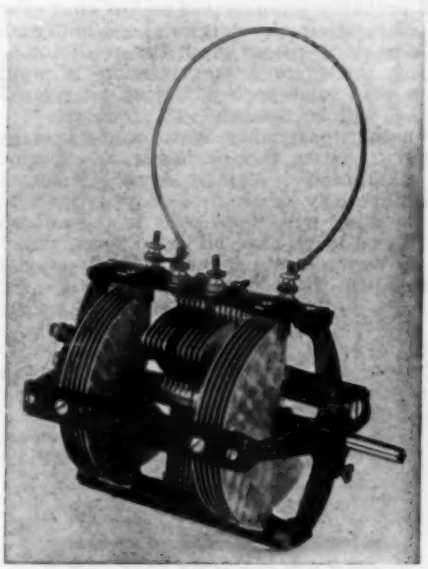
Calibration

Calibration is dead simple. Start the oscilator, tune in the Lecher-wire, locate wires A and B as in Fig. 3F and reach for the yardstick. Then leave both the wires and the oscillator *absolutely alone* while you tune in the wavemeter and mark the wavelength on its scale. I will bet that the first point is some odd one like 6.37 meters—but it will be accurate.

Sending

By this time you are used to the ways of the oscillator and have begun to wonder how it will work with an antenna.

Antenna systems that will work at this



THE 5-METER WAVEMETER

5-meter wavemeter made of Bruno 4-section condenser. Range with the coil shown is from 4-10 meters. Capacity of condenser when connected as shown is approximately 125 micromicrofarads.

wavelength are shown in Fig. 6. You will recognize A as being our ancient friend the Hertz oscillator and B as Marconi's original vertical antenna. They are time tested and are excellent radiators—even if a lot of buncombe is being spread to the

effect that they have just been invented at this or that experimental station.

Assuming that you are using a C-302 tube and have the antenna losses down to a decent value, the antenna current should be from .3 to 1 ampere. You will be surprised to find how far away from the

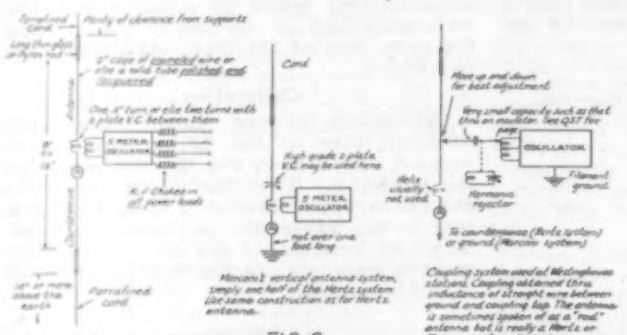

Flexible Cord
Ready of clearance from supports
Long the glass or Pyrex rod
5" coils of enameled wire or else a solid tube polished and lacquered
One 5" turn or else two turns with a plate V.C. between them
5 METER OSCILLATOR
R.F. Chokes in all power leads
Cord
High grade 2 plate V.C. may be used here
5 METER OSCILLATOR
not over one foot long
Move up and down for best adjustment
Very small capacity such as that thru an insulator. See QST for page
OSCILLATOR
Filament ground
Helix usually not used
Harmonic rejector
To counterpoise (Hertz system) or ground (Marconi system)
Flexible cord
Marconi vertical antenna system, simply one half of the Hertz system like same construction as for Hertz antenna.
Coupling system used at Westinghouse stations. Coupling obtained thru inductance of straight wire between ground and coupling tap. The antenna is sometimes spoken of as a "rod" antenna but is really a Hertz or Marconi system depending on use of counterpoise or ground
The old Hertz straight line antenna which is being "revived" under a variety of fancy names

FIG 6
SHORT WAVE ANTENNAS

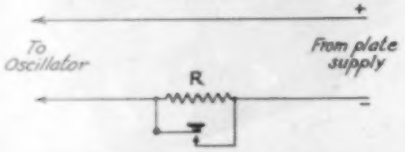
antenna your wavemeter combination will burn out Mr. Woolworth's lamps—also you will probably be surprised to find that every bit of metal in the neighborhood will insist on absorbing power from the oscillator.

For satisfactory transmission it would seem that some such mounting as given in Fig. 6 will be needed—out of doors.

Another possibility is to work a larger antenna system at a harmonic, as explained by 8XC in the August issue. Keep the coupling very loose tho—if you don't the whole thing will "flop" over to the antenna wave and work as a Meissner circuit on 15 or 25 meters—and we are not supposed to show up in those neighborhoods.

The Receiver

It is hardly necessary to describe the receiver—for it is just the transmitter all



Adjust R to give about 2000 cycle shift in received note. More than this will make trouble.

FIG. 7 KEYING SYSTEM

over again. Instead of the 5 watt tube use a C-299 or else a UV-199 *without a socket*, and still better without a base (See Fig. 6, page 12, Sept. *QST*.) If you can't get this tube take the base off a WD-12 or a C-301A. Whatever tube is used it MUST be mounted on felt as shown in the figure just referred to or you will have a horrible time with the signals.

The circuit is exactly that used in the sending oscillator—with the one small difference that the tuning is done by a 2-plate (one moving and one stationary) variable condenser connected from the grid to the filament and provided with a 10-inch wooden shaft-extension to lower the hand-capacity effect. It is necessary to use the R.F. chokes as before, else the batteries will get into the argument and you can't move your feet without having the signal skip out of hearing. Since the currents are very small the chokes can be wound with the smallest wire you can handle in basket-weave coils, or else you can use chokes wound on pencils with the wire from the ever-helpful Ford coil.

Troubles

All these preliminaries will take you about a week—unless you are John Reinartz who can do all of it in one evening—and

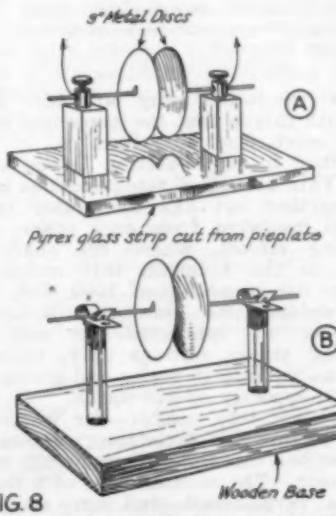


FIG. 8
AIR CONDENSERS FOR USE AT HIGH FREQUENCIES

A - *Type suggested by Mr. Richardson 320*

B - *Cheaper type —*

Supports are glass tubes driven into wooden base The Fahnestock spring binding posts are soldered to brass machine screws one inch long and these are cemented into the top of the glass tubing with sealing wax from a battery or with hot shellac. Pyrex tubing is better but ordinary glass will pass.

then the real fun begins. When the sending key is put in the plate supply the note

whines and whoops all over the scale. That can partly be cured by not using too good a plate supply. That isn't exactly what I mean—by using something that has a little ripple on it. The voltage regulation of the plate supply must be very excellent—in other words the plate transformer must be well designed, the rectifier large and without sparkling or boiling. If a generator is used it should be much too big for the job and be flat compound—neither over-compound nor under-compound. This is mighty important, in fact even a storage battery is hard to "hang onto" if one insists on using pure D.C.

The trouble is plainly that the tube shifts frequency when the plate voltage changes—moral, don't change the plate voltage—much. This can be avoided by the keying scheme shown in Figure 7.

WNP Nearing Home

PROBABLY by the time this issue of *QST* reaches you, WNP and Don Mix, the "wireless operator," will be home from a fifteen months cruise into the far north. Unless plans miscarry, the *Bowdoin* will dock at Wiscasset, Maine, about September 18th.

Under the guidance of her owner and captain, Professor Donald B. MacMillan, the sturdily built little auxiliary schooner sailed from Wiscasset, June 23, 1923. She is named after Bowdoin College, Dr. MacMillan's alma mater. Governor Baxter of Maine and many hundreds of visitors saw the departure of the *Bowdoin*, but nothing like the number who will watch her as she returns to the little harbor at Wiscasset. The expedition into the far north was for scientific purposes and this was her first trip with complete radio equipment for transmission and reception. Being assigned the call WNP (wireless north pole) she was permitted to communicate with amateur or commercial stations, depending upon circumstances. To our knowledge, no communication has been had with commercial stations, practically all of it being with amateurs.

Just a year ago, when the *Bowdoin* was nearing Etah, Greenland, Jack Barnsley, Canadian 9BP, became the outstanding figure in amateur radio when he established reliable communication with WNP for a period of many weeks. Then there was a long period of silence with a meager report of signals heard now and then. In July 1BVR broke the long silence by taking a brief message from her and then nothing of importance happend until August 17th, when a British amateur reported hearing WNP. From early August Major Borrett, Canadian 1DD, has had a constant watch out for WNP and his gang of ROTABs stood by nobly. Taking turns, they camped out for WNP night after night.

On August 20th 7AV was in communication with WNP, but there was nothing definite one way or the other because WNP was fading badly and QRN was heavy. 9EBT and Canadian 4DQ logged WNP on the 25th. 9CDV took part of a press message thru heavy QRN and bad QSS on the 26th. Milton Mix, Don's brother and operator at 1TS, heard WNP at this time. On the 27th 9CDV went back after WNP and took the balance of the press message and learned that WNP was at Godthaab, Greenland. From this report we learned that WNP was frozen in for 320 days—brrrr!—it makes us shivver. The Greeley Memorial, sent by the National Geographic Society, was set up at Starvation Camp on May 6th, according to the report. The expedition covered 2000 miles with dog-team and sledges in addition to carrying out other scientific observations.

2CBG also hooked up with Mix on the 27th and 28th, while 1CNA and 9BPF logged him but did not work him. 8PS reports hearing WNP on September 2nd as he was calling Canadian 1AR.

1RV worked WNP on September 4th and took some traffic, with a short press message. WNP was near Saglek Bay, Labrador, having crossed over from Greenland, in a fast run of 58 hours. At the time of communication, WNP was entering Jack Lane Bay, planning to arrive at Hopedale on the 5th; Indian Harbor, the 7th; Battle Harbor, the 10th; Sydney, N.S., the 15th; and Wiscasset, Maine, about the 18th.

While no details are available at this writing, 1RV again worked WNP on the 5th of September and 1TS had a brief communication with WNP. Milton Mix was on the key at 1TS and Don at WNP.

Don Mix's own story will appear in *QST* as soon as possible, but if in the meantime you can get to hear Captain MacMillan's lecture, don't fail to go. He illustrates with slides and movies and he will fascinate you with a most interesting story.

—*F.H.S.*

A Study of Superheterodyne Amplification

By H. A. Snow*

IN ORDER to get some quantity information on the operating characteristics of amplifiers employing the superheterodyne principle, more especially as to amplification and selectivity, a series of measurements were made on a typical amplifier under practically the same conditions that exist in actual reception of radio telephone signals.

The set used in these measurements was made in accordance with the diagram of Figure 1. Regeneration in the amplifier stages was controlled by means of the potentiometer (losser) connected across the A battery.

The only special care taken in the construction of the set was in completely shielding the oscillator and partially shielding the amplifier to prevent induction of stray voltages in the set. A switching arrangement consisting of three separate switches, widely spaced to reduce the capacity between stages, was incorporated in the amplifier, to enable cutting one or two stages of amplification out of the circuit. To avoid unnecessary complication, these switches are not shown in the diagram.

UV-201A tubes were used throughout the amplifier with a filament voltage of 5 and plate voltage of 80.

Definitions

In the superheterodyne system of amplification, the radio-frequency (R.F.) voltage to be amplified, which will be called the R.F. *signal voltage*, is impressed upon a detector in a suitable input circuit, combined with a second R.F. voltage whose frequency differs from the signal voltage by a suitable intermediate frequency. This second R.F. voltage may be conveniently supplied by a separate oscillator, and will be termed the R.F. ***heterodyne voltage:*** added together, these two voltages produce a composite voltage of varying amplitude, which is impressed on the first detector; this will be termed the R.F. *input voltage*. This input voltage is partially rectified by the first detector, which thus impresses upon the first stage of the intermediate-frequency (I.F.) amplifier, an I.F. input voltage, whose frequency is the beat frequency of the R.F. signal and R.F. heterodyne voltages (see Fig. 1). (Writers on the superheterodyne insistently overlook the fact that rectification is necessary before there can be a resultant frequency.—Tech. Ed.)

The R.F. input voltage is amplified by one, two, or three stages of I.F. amplification, coupled by fixed transformers having suitable resonance characteristics, and in amplified form is impressed upon the second detector, where it is rectified to produce a direct-current or audio-frequency output. This output will be termed the *response* of the amplifier

For convenience the present measurements were all made using an unmodulated R.F. signal voltage (C.W.); accordingly, the output of the second detector is direct current which can be conveniently measured by D.C. instruments.

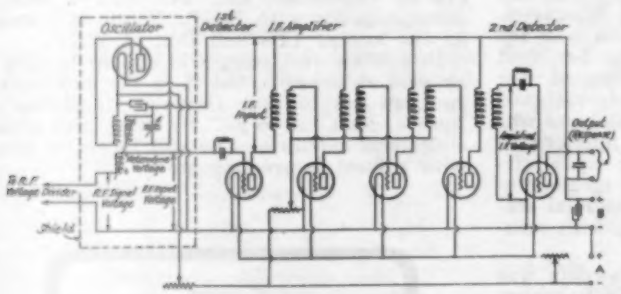


FIG. 1 CIRCUIT DIAGRAM

3—Method

Two general types of measurement were made:

1. Voltage amplification per I.F. stage, and amplification due to heterodyne action in first detector.

2. Output from second detector as a function of the frequency (wavelength) of the R.F. voltage.

The R.F. signal voltage for the amplifier was obtained from the drop across the resistance through which a radio frequency current was flowing. This current was supplied from a shielded high frequency generator located at some distance and feeding through shielded leads. The usual preliminary tests were made to insure the absence of direct induction. The current was measured with a thermo couple and galvanometer, the input voltage being calculated as the product of the current and the resistance through which it flowed. Special single-wire resistances were used. They had rigid, right-angle leads and all units were subjected to preliminary tests at the frequencies used to allow correction for inductance and capacity.

*Radio Frequency Laboratories, Inc., Boonton, N. J.

The response of the amplifier to a given input voltage is manifested in the plate circuit of the second detector as a change in the direct plate current of this detector. It was measured with a direct current microammeter in series in the plate circuit, this meter having the normal detector plate current balanced out with suitable batteries and resistances so that it indicated directly changes in the plate current. This response is a direct measure of the signal intensity which would be obtained in a telephone receiver in the plate circuit of the second detector for a completely modulated received voltage imposed on the input.

The voltage amplification of any given stage or combination of stages in the amplifier was determined as follows:

First: With the stages to be measured included in the amplifier, a 750-KC. R.F. signal voltage (400 meter wavelength) was impressed on the input circuit of the first detector and the amplifier was adjusted for best reception. This adjustment consists of: (1) tuning the oscillator to a frequency at which the beat note is most strongly amplified by the I.F. amplifier; (2) adjusting the oscillator coupling to give optimum strength of R.F. heterodyne voltage, as indicated by maximum response; (3) adjusting the stabilizer (losser) on the I.F. amplifier to allow maximum (or any desired value below maximum) of regeneration. The amplifier being adjusted, the response was noted on the balanced micro-ammeter in the plate circuit of the second detector.

Second: The stages to be measured were cut out of the I.F. amplifier, and the remaining stages were readjusted for best

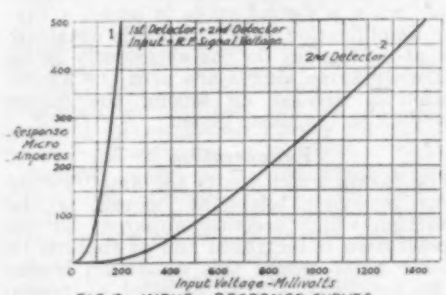


FIG 2 INPUT - RESPONSE CURVES

reception without changing the oscillator coupling. The R.F. signal voltage was increased until the detector response was the same as that previously obtained when the stages being measured were included in the amplifier.

The response being the same in both cases, the intermediate-frequency voltage impressed on the second detector must be the same in both cases, and the ratio of the two signal voltages for equal response must be *independent of the rectification characteristics of the second detector.* Thus if the amplitude of the I.F. voltage impressed by the *first* detector upon the amplifier were directly proportional to the R.F. signal voltage, this ratio of the two voltages would be exactly equal to the voltage amplification of the stage or stages which were

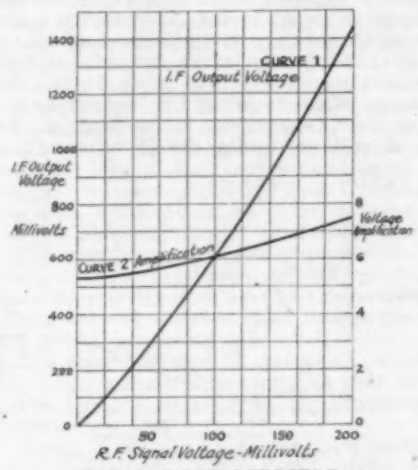


FIG 3 FIRST DETECTOR

cut down when the signal voltage was changed. This I.F. voltage is, of course, produced by the rectification of the R.F. signal beating against the constant heterodyne voltage from the oscillator, and according to the theory of heterodyne detection, should be proportional to the R.F. signal. It was considered advisable to verify this point experimentally for the voltage amplitudes and the particular detector tube used in the course of these measurements. This was done as follows:

Measurement A.
Relation of Response to Signal Voltage

The I.F. amplifier was provided with coupling transformers approximately resonant to a frequency of 30 KC (10000 meters). The R.F. signal voltage was set at a frequency of 750 KC (400 meters) and the R.F. heterodyne voltage was set at a frequency of 780 KC and optimum amplitude. This optimum amplitude was not critical and was substantially independent of frequency over the range of frequencies used. The R.F. heterodyne voltage was then kept constant in amplitude and frequency and the amplitude of the signal voltage was varied over suitable ranges, measured in millivolts, and the response was measured, with the first detector operating directly into the second detector, both without in-

termediate stages and with one, two, and three, intervening I.F. stages.

Curve 1. Figure 2, shows the response in microamperes, plotted against signal voltage in millivolts (constant heterodyne voltage) for the first detector working into the second detector through only *one* I.F. transformer. Curve 2 shows the input response characteristic of the second detector, plotted for comparison on the same ordinate scale. Under the conditions of Curve 1 the output voltage from the first detector is equal to the input to the second detector, therefore the abscissae of Curves 1 and 2 for any given set of ordinates furnish the data for a curve on the first detector alone showing I.F. output voltage from this detector as a function of R.F. signal voltage, under the given conditions

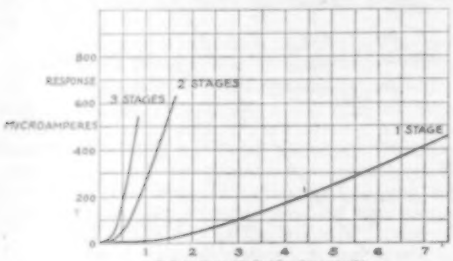


FIG. 4 INPUT-RESPONSE CURVES

of constant heterodyne voltage. This curve (Fig. 3. Curve 1) is not quite a straight line. The second curve of Fig. 3 shows the ratio of these two voltages as a function of the signal voltage, and is thus a measure of the heterodyne amplification in the first detector. This amplification varies somewhat with the signal amplitude, but Curve 2 furnishes the necessary data for corrections on voltage-amplification measurements by the method outlined above.

Figure 4 is a set of signal-response curves for one stage, two stages, and three stages of I.F. amplification. It shows graphically the advantage of adding I.F. stages, and also indicates by the similarity in their shape to the shape of the input response curve on the second detector, that the only non-linear element in the whole system is the second detector.

Measurement B. Voltage Amplification Amplifier

Following the procedure outlined on page 20, measurements of the voltage amplification in the I.F. stages were made for two types of I.F. transformers. Most of the measurements were made with R.F. signal voltages of 0.1 to 24 millivolts and over this range the amplification in the first detector varies less than 3%, which renders unnecessary the use of Curve 2 Fig. 3 for correction purposes. In a few measurements where the signal voltage exceeded 25 millivolts a correction was made to compensate for the change in amplification of the first detector.

The average of a considerable number of measurements of the amplification for each stage in the amplifier and for the whole amplifier are given in the following table:

The two types of transformers used are designated by the letters GR and DX, the type designated as GR operating nominally at 10,000 meters and that designated as DX operating at 5,000 meters. The transformers of each set are practically identical among themselves.

Transformer	Voltage Amplification				
	1st Detector	I.F. 1st Stage	I.F. 2nd Stage	I.F. 3rd Stage	Total
GR	4.8	35	8.5	2.4	3400
DX	3.7	53	4.7	2.9	2700

If regeneration in the intermediate stages was increased to the maximum possible without oscillations occurring, the total amplification was increased to about 10,000. Under these conditions the amplifier could be used for reception of telegraph signals (CW, spark, etc.) although the distortion is entirely too great for satisfactory telephone reception.

Since the output of the second detector is proportional to the square of the amplified I.F. voltage for *weak signals*, it is seen that the total increase in output on a weak signal, due to the I.F. amplifier is enormous.

The value in the above table for any particular stage represents the actual increase in amplified I.F. output produced by adding that stage to the amplifier. For example, with GR transformers the first detector amplifies the signal voltage 4.8 times. When 1 stage is added to this, the resulting I.F. voltage is amplified 35 times more; when a second stage is added a further amplification of 8.5 times is obtained. The above figures do not necessarily mean that when three stages are used the amplification is divided up among the stages according to the value given.

Regeneration

The factor which limits the amplification when receiving telephone signals is the distortion which becomes apparent as the regeneration is increased and as there is no definite point where this distortion begins to be noticeable the adjustment of regeneration for best reception is rather indefinite. For this reason it is difficult to repeat amplification measurements after readjusting the amplifier with a variation of less than about 25%. These conditions exist in actual reception, however, so no attempt was made to obtain more accurate values.

Since the amplification measurements were made with an unmodulated input voltage it was necessary to have some means of adjusting the regeneration to a point

corresponding to that for best reception of a phone signal. It was found in receiving phone signals that the distortion due to regeneration was reduced to a negligible amount when the mean grid voltage was set at about +.2 volts below the voltage at which oscillations begin. That is, the mean grid voltage was gradually made more negative until oscillation began, then a change of +.2 volts from this point reduced the regeneration and distortion sufficiently for good reception, as judged by the operator. This method of adjusting the amplifier was used in obtaining the values given in the above tables. These values, then, correspond to conditions practically the same as used in actual reception and represent the maximum amplification that it is possible to use for good clear reception of phone signals.

Measurement C.
Variation of Response with Wavelength

The last series of measurements were made to obtain some information as to the selectivity of the superheterodyne amplifier.

First, using three stages of amplification with the amplifier adjusted for best reception at 400 meters and with the regeneration increased until close to the oscillation point, the response was measured for various frequencies of R.F. signal voltage. The amplitude of this voltage was kept constant.

Second, with the same input voltage, the regeneration was reduced to that corresponding to good reception of a phone signal and again the response for varying frequency was obtained.

Curves 1 and 3 of Fig. 5 show the results of these measurements.

Similar curves were obtained using one, two and three stages of amplification with the amplifier adjusted to conditions corresponding to good phone reception. In Fig. 6 are given wavelength-response curves for the GR transformers with the heterodyne oscillator set at 400 meters. Fig. 7 shows similar curves for DX-transformers with the heterodyne set at 370 meters, except that only one-half of the complete resonance curve is shown, the other half being below 370 meters and practically symmetrical with that shown.

Discussion of Results
Distortion in the Superheterodyne

Two kinds of distortion may exist in the superheterodyne amplifier when receiving telephone signals, the first of which is due to the fact that the response is not directly proportional to the input voltage to the amplifier, as shown by the curves in Figs. 2, 3 and 4. The source of this distortion may be divided into two parts: (1) Variation in amplification in the first detector and in the amplifier stages with different input voltages and (2) lack of linear relation between input and response of the second detector.

(1) Variation of amplification with different input voltages is comparatively small over the range of voltages ordinarily used with the amplifier, and as a source of distortion may be neglected.

(2) The lack of linear relation between input and response of the second detector as shown in Curve 2, Fig. 2, and which is also evidenced in the lower ends of the curves in Figs. 2 and 4, causes distortion when receiving weak signals. The response curves are practically straight lines between responses of about 150 and 1200 microamperes; above 1200 the slope gradually decreases again. So for very strong signals, such as would correspond to a response above 1200 microamperes, distortion also occurs. For signals corresponding to responses between about 150 and 1200 microamperes, there would be practically no distortion produced in the second detector.

The maximum voltage that can be applied to the amplifier without producing distortion is limited by the characteristics of the second detector tube rather than by any of the preceding tubes.

The second source of distortion, which is by far the more important, is due to the sharpness of the peak of the wavelength-response curves.

Curve 1 of Fig. 5 shows this variation with wavelength when using high regeneration in the intermediate stages. If the amplifier was so adjusted that the peak of this curve was set on a 400 meter telephone

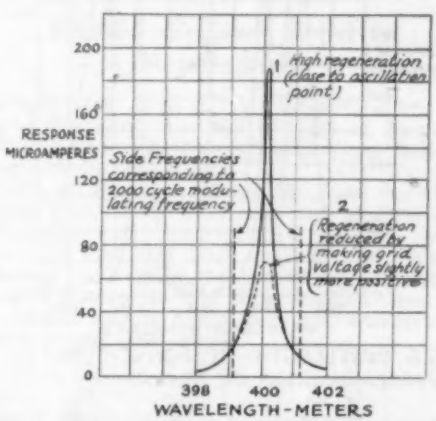


FIG. 5 WAVELENGTH-RESPONSE CURVES
Constant Input Voltage G.R. Transformers 3 stages.

carrier wave modulated at 2000 cycles, the two side frequencies corresponding to this modulation would be at the positions shown by the vertical lines. The response of the amplifier to the carrier wave in this case

would be about 12 times as great as the mean response to the side frequencies. Under these conditions, considerable distortion was apparent when actually receiving telephone signals.

With regeneration reduced sufficiently to give signals of good quality, the wavelength response Curve 2 was obtained. In this case the response to a carrier wave modulated at 2000 cycles would be about 4 times as great as the response to the side frequencies.

In order to compare the distortion shown in the curves of Figs. 5 to 7, a ratio of the response obtained at the peak to the response obtained at arbitrary side frequencies 2000 cycles on each side of the peak may be taken as an indication of the distortion. This can be expressed as per cent. distortion by using the ratio:

$$\text{Distortion} = \frac{\text{(Response at peak)} - \text{(response at 2000N side freq.)}}{\text{(response at peak)}}$$

0 distortion would mean that no decrease in response occurred for frequencies 2000 cycles on each side of the carrier wave; 100% distortion would mean that the response had dropped to zero within 2000 cycles of the carrier wave.

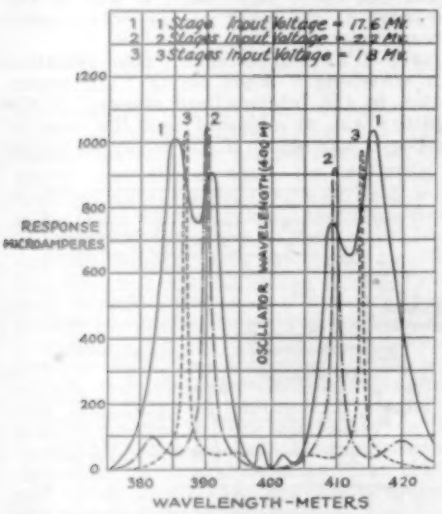


FIG. 6 WAVELENGTH-RESPONSE CURVES
Constant Input Voltage GR Transformers

The curves in Fig. 5 show distortions as follows:

Curve	Per Cent. Distortion
2	91.5
	77.

By the same method, the distortions obtained when using 1, 2 and 3 stages of amplification with both types of transformers, from Figs. 6 and 7 are as follows:

Transformers	Per Cent. Distortion 1 Stage	2 Stages	3 Stages
GR	5.	71.	88.
DX	53.	40.	75.

The average of the above values is 55%. Since they were obtained with amplifier conditions corresponding to reception without *apparent* distortion, it follows that a distortion of the neighborhood of 50%, as calculated herein, can exist without seriously affecting the quality of a telephone signal.

Selectivity

The selectivity of an amplifier, which may be defined as its effectiveness in reducing interference from signals on wavelengths near the one to which it is resonant, is shown not so much by the sharpness of the peak of a wavelength response curve as by the height of this curve at some distance on each side of the peak.

Since the response curves in Figs. 6 and 7 are irregular at the lower ends, using a measurement of the height at a given distance each side of the peak to indicate relative selectivities is unsatisfactory. A better measure of the selectivity for these particular curves would be the width of the peak in meters at some arbitrary low value of response, say 5% of the peak value. If we divide the average wavelength, 400 meters, by this peak width, we obtain a selectivity factor which is independent of the wavelength.

This selectivity factor is given in the following table for both types of transformers:

Transformers	Selectivity Factor 1 Stage	2 Stages	3 Stages	Average
GR	21	27	39	29
DX	53	36	62	50

Comparison of Transformers

The GR transformers give a greater amplification than the DX transformers when using 2 or 3 stages, although in one stage the DX is higher owing to the higher regeneration produced by this transformer in one stage.

The distortion is about the same for both transformers with the exception of 1 stage of GR transformers. The low distortion shown in this case is also due to the low regeneration existing in one stage with GR transformers. Equal distortions with both types of transformers might be expected since this factor was purposely set as nearly constant as could be determined by judging the quality with the ear.

The selectivity factor for the GR transformers is lower in all three combinations of amplifier stages than those for the DX.

transformers, the average being 29 for the GR and 50 for the DX.

In practical operation it was found that a wide range of audible frequencies produced by beating of the oscillation and signal frequencies was very audible in the telephone receivers when using GR (30 kc.) transformers in the amplifier. This was somewhat objectionable and interfered with the reception of a signal when receiving one or two signals having wavelengths near together.

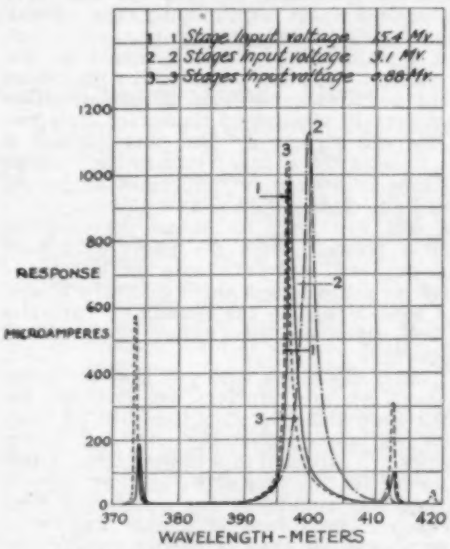


FIG 7 WAVELENGTH-RESPONSE CURVES
Constant Input Voltage DX Transformers

With DX (60kc.) transformers these beat frequencies could not be heard.

Considering the above facts: that while the short wave transformer does not give an amplification quite as great as the long wave transformer for the same distortion, it is more selective and it is not as noisy when tuning as the long wave transformer; it appears that the 30 kc. (10,000 meters) used in the GR transformers it too low a frequency for best results in the I.F. amplifier. This work was not designed to be an investigaiton of I.F. transformers, but it points to the general conclusion that a higher intermediate frequency is better from an operating standpoint. There is moreover, no fundamental reason why transformers cannot be designed to yield as high amplification per stage at 3000 meters as is given by the GR transformers at 10,000 meters.

Summary

The most important result of this investigation is the general conclusion that with an efficient type of I.F. transformer, using controlled regeneration in the I.F. stages, it is possible with 3 I.F. stages to obtain a voltage amplification as high as 3500 fold ahead of the main detector, without serious distortion due to the elimination of side bands. That is, a modulated voltage received from a radiophone transmitter and impressed on the detector may be 3500 times as great with the superheterodyne amplifier as without it. The amplifier used in these experiments employs five UV-201-A tubes ahead of the second detector. If the first detector be used as oscillator without loss in heterodyne amplification, as is said to be done in the superheterodyne sets of the Radio Corporation, then we can assume as a safe maximum the factor of 3500 in *four* tubes ahead of the detector.

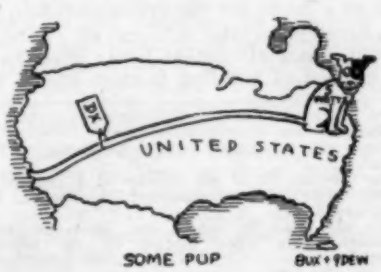
The amplification furnished by the standard neutrodyne circuit is about 7 in the first stage and 4 in the second with an increase of 10 to 15 in the commercial sets due to uncompensated regeneration. Thus we can take the factor 300 to 450 with two tubes, as characteristic of the neutrodyne. Uncompensated tuned radio frequency stages, such as the simple Variotransformer system are of the same order of magnitude for two stages, and increase by a factor of about 2 on adding a third stage. Thus a safe estimate for uncompensated tuned R.F. amplification is 300 with two tubes and 600 with 3 tubes. These figures furnish some basis for estimating the relative order of magnitude of superheterodyne amplification.

1XAM Copied Solid in Australasia

ON May 29th, station 1XAM, John L. Reinartz, was calling CB8 at Buenos Aires. Directly afterward he talked for a time with 9ZT.

All of this was copied by New Zealand 1AO, Mr. R. White, and by Australian 3BQ, Maxwell Howden. 1AO gave the time as 8:00 P.M. and 3BQ as 7:00 P.M. This checks, as there is one hour's difference between Australian and New Zealand time.

1XAM was on 108 meters and was using an *input* of 1000 watts.



The Receiving Coil Problem

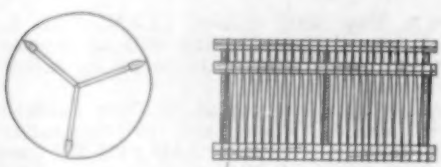
The Author of "The Basket Weave Coil" Discusses Spiderweb and Cylindrical Evils

*By Greenleaf W. Pickard**

MY BRIEF investigation[1], confined as it was to a zig-zag wound cylindrical coil of three and a quarter inches diameter, has barely scratched the surface of the real problem.

I called this particular form of coil the Lorenz, which perhaps needs some qualification. Altho the particular method of winding coils with turns which zig-zag across each other is now twenty years old in this art, it was first applied, if my memory is not at fault, only to flat or spider-web coils by the Lorenz Company, and cylindrical coils embodying this principle of winding are not only more recent, but until *QST* began its series of articles on the low loss tuner, were comparatively little known in this country.

Speaking of spider-web coils reminds me of the fact that their only raison d'etre is one of convenience; because they are flat they fit nicely in a cramped, Procrustean tuner arrangement. I satisfied myself sometime ago that for similar dimensions they are *not as efficient as cylindrical coils*, even if, as in their more modern forms, the important dielectric of the spokes is removed, and for this reason I abandoned their further study. Probably for a given inside diameter of the spiral spider-web coils of the same inductance but of different wire



..... with such a support — we could forget about dielectric losses.....

gauges would show somewhat similar curves to those I made for the cylindrical coil.

Returning to the subject of cylindrical coils, it seems altogether likely that the zig-zag method of winding is most useful when the coils are closely wound. If the turns are spaced apart logitudinally, the advantage of this lateral spacing is rapidly lost, and a plain helical winding should be just as efficient. A plain helical coil with spaced turns requires some form of support, that is, a certain amount of imperfect dielectric in the coil structure. But this support is not necessarily a tube; it may be reduced to three thin hard rubber combs supported on a light central spider, as with heavy wire the coil will keep its shape perfectly on such a frame. With a support as I have just outlined, and bare wire for the coil, I think we could forget about dielectric losses, and concentrate on the remaining variables of coil diameter, wire gauge, spacing and frequency.

I heartedly agree with you that the ramifications of this problem are endless; for this reason alone we should not bite off more than we can comfortably chew, if useful results are expected in a limited time. There is no special difficulty about such an investigation, the apparatus for measuring high frequency resistance is simple and well-known[2] and all that is needed in addition is someone who will spend a few days or weeks in making up and measuring a series of coils. I'd like to do it myself, but I am busy just now trying to find out what the waves from WGY do when they pass from dry sand to wet salt water at Seabrook Beach (some of the waves bounce back and mix it up with later arrivals) and the equipment I am using for this purpose does not lend itself very well for work on the coil problem.

My suggestion is that the initial investigation should be limited to cylindrical spaced-turn coils of four, six, eight and twelve inches diameter, wound with four widely different sizes of wire, such as Nos. 16, 12, 8 and 4. Four different spacings might be used, starting with the turns nearly in contact, so that *only* sixty-four coils need be constructed. If measurements were made at three frequencies, there would be less than two hundred resistance determinations, and a tabulation of these results, or their plotting[3], should give an excellent survey of the field. After the best coils in each diameter were approximately determined, a few additional constructions and measurements might be required to determine the best coils more precisely. No doubt the best coils in each diameter would form a series decreasing in resistance with

*Chief Engineer Wireless Specialty Apparatus Co.; inventor of the crystal detector.

1—Page 39, September QST, "The Basket-Weave Coil."

2—See Circular 74 of the Bureau of Standards; 60¢ cash from Superintendent of Documents, Washington, D.C.

3—See the way in which the Basket-weave coil measurements were plotted in the September article.

increase of diameter, and as the diameter increased the best size of wire would also increase, similarly the optimum spacing. Coils under four inches in diameter are probably too small to be efficient, and anything over twelve inches is too big for receiver use.

Altho this sounds like a lot of work, the chances are that the first few measurements would show the absurdity of certain constructions, and perhaps half the work could be eliminated.

Cunningham Tubes Direct Too

MESSRS. E. T. Cunningham, Inc., have advised us of their willingness to supply Cunningham power tubes direct to our members when they cannot be obtained locally, in the same fashion as the Radio Corporation of America agreed to do as announced on page 25 of *QST* for August, which see.

It is necessary first to endeavor to purchase the tubes from your dealer. If unable to procure them from that source, E. T. Cunningham, Inc., 182 Second St., San Francisco, will sell the C-302 5-watter and C-303 50-watter direct upon receipt of cash or money order, together with a statement that the tubes could not be purchased locally and giving the names and addresses of the dealers that did not have them. The arrangement applies to these two power tubes only.

—*K.B.W.*

Standard Short Waves for Both Coasts at Last

6XBM Joins WWV

AS ANNOUNCED in the regular weekly A.R.R.L. broadcasts, 6XBM has joined WWV in sending standard waves. 6XBM is the station of Leland Stanford, Jr., University at Palo Alto, Cal. A trip to the coast was made by Mr. Walls of the Bureau of Standards and much very careful work done to make absolutely sure that the transmission of 6XBM comes up to the high standard that has been set by WWV, the Bureau's own station at Washington. Three different check methods were used. We do not know what all three of them were but know that some standard wavemeters were sent across, also that transmission tests were made and the received wave carefully measured. The first schedules of 6XBM were unfortunately received too late for September *QST*.

Both WWV and 6XBM can be depended on for accuracy better than 3/10 of 1%.

Notice that all schedules are given in *Standard* time, each station using the time of its own region.

Information on the use of these transmissions is given in Bureau of Standards Letter Circular No. 92 which may be had by applying to Radio Section, Bureau of Standards, Washington, D.C.

We expect the transmission of still shorter waves next month—watch the weekly A.R.R.L. broadcasts for details. If you don't know about these broadcasts get into touch with the nearest Traffic Department official whom you will find listed in the front of each issue of *QST*.

Schedule of Frequencies in Kilocycles

(Approximate wave lengths in meters in parentheses)

Time*	Oct. 8	Oct. 21
10:00 to 10:08 P.M.	1350 (222)	1900 (158)
10:12 to 10:20 P.M.	1420 (211)	2000 (150)
10:24 to 10:32 P.M.	1500 (200)	2200 (136)
10:36 to 10:44 P.M.	1600 (187)	2400 (125)
10:48 to 10:56 P.M.	1700 (176)	2600 (115)
11:00 to 11:08 P.M.	1800 (167)	2800 (107)
11:12 to 11:20 P.M.	1900 (158)	3000 (100)
11:24 to 11:32 P.M.	2000 (150)	3200 (93.7)

*Eastern Standard time for WWV, Washington, D.C.
*Pacific Standard time for 6XBM, Palo Alto, California.

Be Careful, Gang

THE new regulations of the Department of Commerce permit operation on 75-80, 40-43, 20-22 and 4-5 meters *only* if

1—Your license has been changed to permit such operation.

2—You are using an inductively coupled sending set.

Many do not seem at all clear on the second point—there must be absolutely *no electrical connection of any sort* between the antenna and the tubes. For legal circuits see page 13 of September, *QST*.

Remember that you don't necessarily have an inductively coupled set just because it happens to use two or three coils. The usual "1DH" and shunt-feed reversed feedback circuits, for instance, use two coils but are not loose-coupled and therefor are not legal on short waves.

Transmission Experiments at 8AQO

Part II

By S. Kruse, Technical Editor

IN THE first part of this article two problems were given; 1, the comparison of large and small antennas at the same wavelength, and, 2, the comparison of ground connection with counterpoise when using the same antenna.

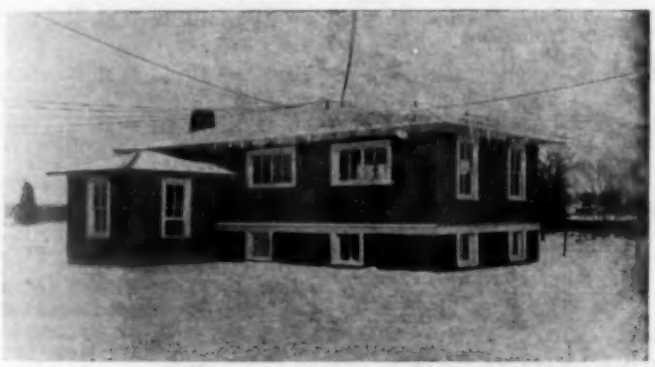
The antenna comparison will occupy most of this installment but the counterpoise-ground comparison has not been entirely completed and will first be considered in another fashion.

For the moment let us continue to regard the "number one" antenna, shown in Fig. 7.

Radiation Resistance

It is interesting to calculate the fashion in which radiation resistance varies as the transmitting wavelength is changed. Ordinarily in such calculations one knows the power in the sending antenna, calculates the radiation resistance from a theoretical formula and thereby arrives at some indication of the field intensity at the receiving point. In this case we know the power in the sending antenna and we also know the field intensity at the receiving point. It is interesting therefore to calculate back for the radiation resistance. The calculation is accomplished by means of the formulas found on pages 730 to 742 of Morecroft's "Principles of Radio Communication." The curves obtained from this calculation are shown in Figure 9. As in the previous part of this dscussion the same antenna is being used first against counterpoise and then against ground. This causes the two systems to have widely different fundamentals. It is good to get an idea of the way they would compare if their fundamentals were the same. This can be done with some degree of correctness by simply sliding one curve along the wavelength scale until the two fundamentals coincide. This has been done in Figure 10.

A similar comparison can be made in the case of the field strength curves which were shown in the first part of this article as Figure 6. These are reproduced again in Figure 11, first as they were originally shown with the wavelengths in register and then with one of them slid over so as to put the fundamentals in register. It can be seen that there is a distinct tendency for the curves to become parallel, as one should expect. The curve for the ground is lower because of the greater ohmic resistance, the effect being especially great at the lower wavelengths. At the higher wavelengths this effect is not of such great importance, being swamped by the dielectric resistance losses which occur with both counterpoise and ground connection.



THE TRANSMITTING STATION

The counterpoise is shown coming in over the top of the building. The trees and buildings to the right are about 200 feet distant altho the photograph makes them appear nearby. See the map on page 17 of the first installment.

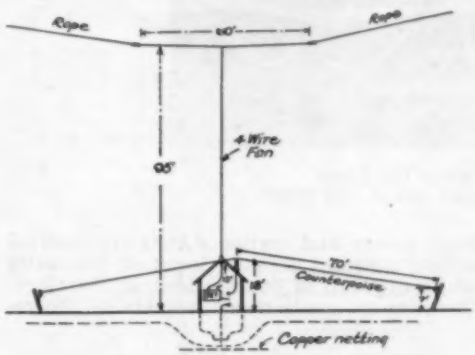
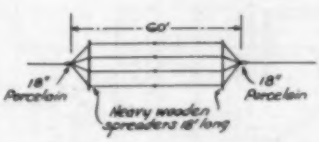
The Number 2 Antenna

So far all work had been done with the same antenna, although it had been used against both counterpoise and ground. It seems worthwhile to find out whether the things that have been spoken of applied to antennas in general or to only this one antenna in particular. The Number 1 antenna (90 feet high and 60 feet long) was replaced by the No. 2 antenna, Fig. 8, which was 90 feet long and 65 feet high,

More through accident than through design its fundamental fell at 262 meters, quite close to the 273 meter of the No. 1 antenna when used against ground. The down-lead of No. 2 was a cage in contrast to fan down-lead of No. 1. In addition the spreaders of No. 2 were made of iron pipe with the wires soldered to them. The idea in general was to make this antenna as different from No. 1 as was conveniently possible.

The measurements which had been made on No. 1 were now repeated on No. 2, using the ground but not the counterpoise.

The nodal points for the various wavelengths were located as described before



THE "NUMBER ONE" ANTENNA
FUNDAMENTAL TO EARTH 272 m.
FUNDAMENTAL TO COUNTERPOISE 221 m.

Fig. 7

and may be seen in Figure 3c in part one of this article.

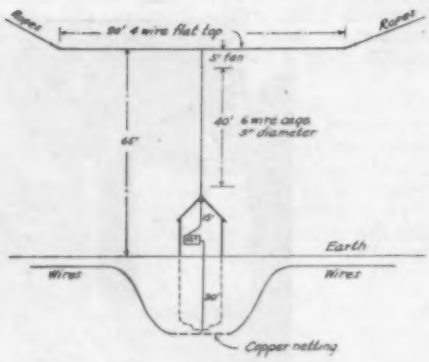
In Fig. 12 are given the field strength curves of the No. 1 and No. 2 antennas when used against ground. In this case it is not necessary to shift them since the fundamentals are close together. Apparently the No. 2 antenna obeys the same general rules as the No. 1 antenna.

In Fig. 13 are shown the radiation resistance curves for the No. 1 and No. 2 antennas, both used against ground. Here also the two antennas have followed the same general rule.

Maximum Output at Various Waves

All of the foregoing has been reduced to the same antenna input power. Most stations are not operated in this way but use fixed filament voltage and operate the generator (or other plate supply) at its maximum voltage at all times.

This test was not run on a scientific



THE "NUMBER TWO" ANTENNA
Fundamental to earth 262 meters

FIG. 8

basis. The generator rheostat was simply set clear over and the tubes operated with the clips set at the best points which had been found for each wavelength. These were not necessarily the best points that could have been found. It is not pretended that the efficiency of the set was the same at each wavelength although the temperature

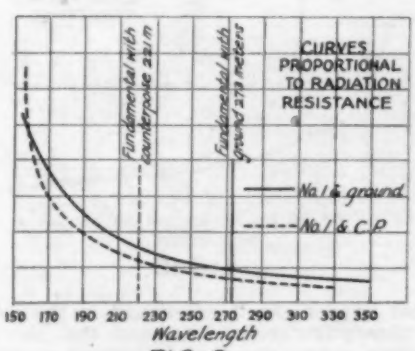

Fundamental with counterpoise 221 m
Fundamental with ground 270 meters
CURVES PROPORTIONAL TO RADIATION RESISTANCE
No. 1 & ground
No. 1 & C.P
150 170 190 210 230 250 270 290 310 330 350
Wavelength

FIG. 9

of the plates of the tubes did not vary widely.

The adjustments are shown in Table B.

It is an interesting, although possibly useless, operation to multiply one of the field intensity curves by the power which the set

was able to put into the antenna at each particular wavelength. This has been done in Figure 14 which shows a field intensity curve for constant power at the transmitter and another for the maximum power which could be put into the antenna at each wavelength using the conditions that have just been described. These two curves and the solid curve of Fig. 6 therefore represent what one may speak of as operating and laboratory conditions respectively.

Figure 14 by no means predicts what will happen at a great distance, it merely shows what field strength can be generated at a distance of 3000 feet—how effective the station is in getting energy into the ether.

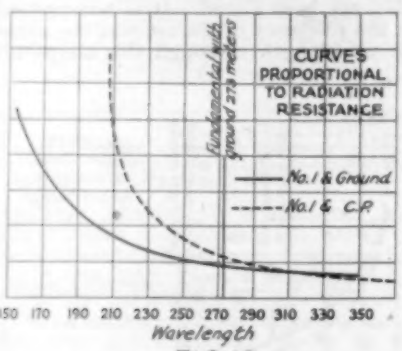
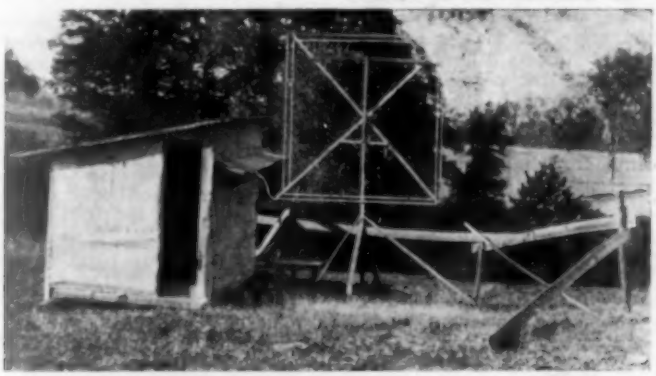

CURVES PROPORTIONAL TO RADIATION RESISTANCE
Fundamental with ground 273 meters
No. 1 & Ground
No. 1 & C.P.
150 170 190 210 230 250 270 290 310 330 350
Wavelength

FIG. 10

What happens to it afterward in the way of absorption, refraction, and the like is another story—one that is beyond control.

Practical Tests

A considerable portion of the radio world has no faith whatever in measurements. The only thing that counts is transmission over a distance. We did not completely share this attitude but nevertheless felt that an experiment of this kind has so many possibilities of error that any confirmation is always welcome and comforting. Therefore tests were arranged on two successive Sundays during broad daylight. During these tests we dropped back to the basis of fixed power and station 8AQO transmitted with a constant antenna input of 300 watts while a group of five stations at Hartford, Connecticut, made measurements of the received signal strength. The distance is approximately 325 miles, all of this being over land.



THE RECEIVING HOUSE WITH ITS LOOP
This station was described in part one of this article.

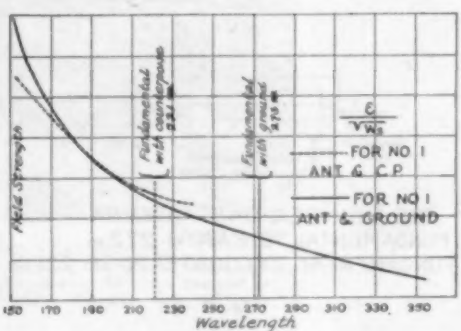

Field Strength
Fundamental with ground 273 m
Fundamental with ground 273 m
FOR NO 1 ANT & C.P.
FOR NO 1 ANT & GROUND
150 170 190 210 230 250 270 290 310 330 350
Wavelength

FIG. 6

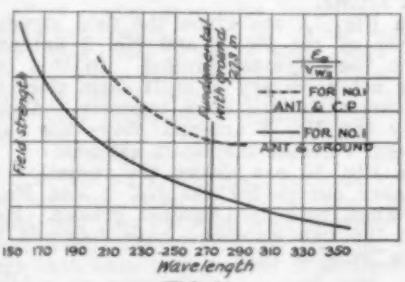

Field strength
Fundamental with ground 273 m
FOR NO.1 ANT & C.P.
FOR NO.1 ANT & GROUND
150 170 190 210 230 250 270 290 310 330 350
Wavelength

FIG. 11

The tests were run on schedule, the transmitting station beginning at the longer waves and working down step by step toward 154 meters.

At this point it is well to say distinctly

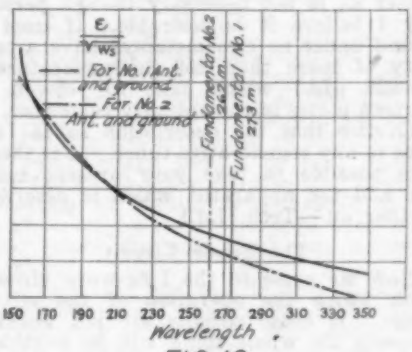

E
V WS
For No. 1 Ant. and ground
For No. 2 Ant. and ground
Fundamental No. 2 263 m.
Fundamental No. 1 273 m.
150 170 190 210 230 250 270 290 310 330 350
Wavelength

FIG. 12

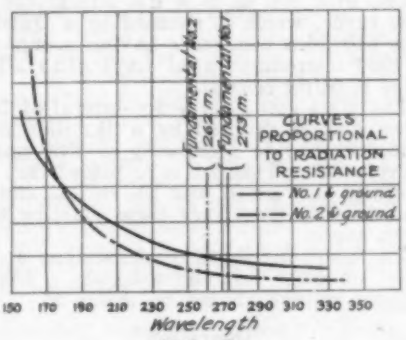

Fundamental No. 2 263 m.
Fundamental No. 1 273 m.
CURVES PROPORTIONAL TO RADIATION RESISTANCE
No. 1 & ground
No. 2 & ground
150 170 190 210 230 250 270 290 310 330 350
Wavelength

FIG. 13

that we realize the extreme inaccuracy of such observation. To begin with the audibility meter is an inaccurate thing, in addition it does not give any direct indication of field strength, and still in addition to that it is being worked with a receiving set about which one knows nothing at all. It is for this reason that 5 observers were used; such a number gives a fair chance that the average result will give some indication of what is really going on. For this reason also several of the wavelengths were repeated.

All of the receiving sets used oscillating detectors with one or two stages of audio amplification. Beyond that there was not the slightest resemblance between them, nor was there any resemblance between the receiving locations. In addition to this there was wide divergence between the audibility measuring devices themselves, some of them not having been calibrated until after the tests were made.

These things are pointed out, partly to admit all of the errors that were possible and partly to show that since any transmission phenomenon which could distinctly be recognized through all these weaknesses must certainly have been of a very distinct nature.

The points obtained scattered badly and only the final curve is shown in Figure. 15. Certainly there is no doubt that the transmission at 154 meters was enormously better than that above 300. The very great rise of the curve towards shorter wavelengths is due not only to the more effective

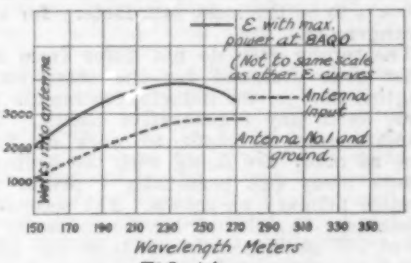

E with max. power at BAQO
(Not to same scale as other E. curves
Antenna input
Antenna No. 1 and ground
Watts into antenna
3000
2000
1000
150 170 190 210 230 250 270 290 310 330 350
Wavelength Meters

FIG. 14

radiation of the transmitting antenna system but probably also the lesser absorption of the shorter waves while traveling to the receiving point. It is not likely that there

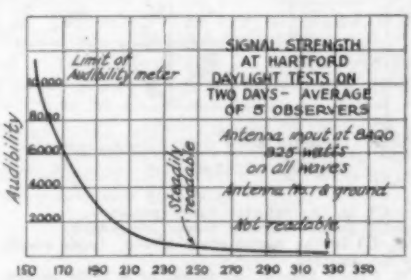

Limit of Audibility meter
SIGNAL STRENGTH AT HARTFORD DAYLIGHT TESTS ON TWO DAYS - AVERAGE OF 5 OBSERVERS
Antenna input at BAQO 925 watts on all waves
Antenna No. 1 & ground
Not readable
Steadily readable
Audibility
8000
6000
4000
2000
150 170 190 210 230 250 270 290 310 330 350

FIG. 15

was anything especially freakish about the transmission condition because the receiving stations not only differed widely as to the nature of their location but were scattered over an area about 20 miles across.

Super-Regeneration and Short Waves

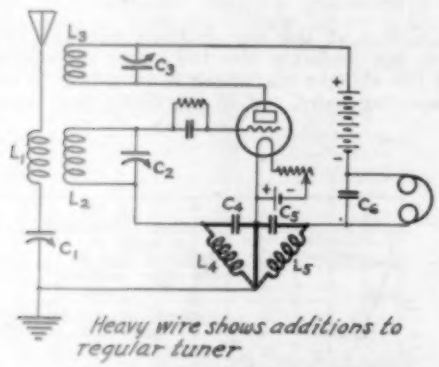
By A. L. Groves

SHORT WAVE development is too young to say with any certainty what is best for this or that purpose, so I shall describe my tuner briefly, giving the arrangement I have found most satisfactory and leave the rest to you for further development.

As can be seen from the diagram, super regeneration is the foundation of the circuit. Let me say quickly to those who have found super regeneration unsatsfactory on the longer waves, that this circuit operates without squeals of any kind. Neither is there a continuous roar.

Strange to say, the WD-11 or WD-12 tube appears to be the most satisfactory for this arrangement.

The tuning coils do not differ from any other coils designed for the same wavelengths, that is, the inductances remain the same as in any regenerative circuit. The primary may be made to work on fixed tune as many are doing with the ordinary tuners today but personally I prefer the tunable primary as shown. The secondary condenser, C_2, should have a capacity of about 125 micromicrofarads (.000125 μfd.) which can be obtained with from five to seven plates in an ordinary variable condenser. The grid condenser is of the usual type, a capacity of 250 micromicrofarads (.00025 μfd.) being suitable. Although a grid leak is shown, the circuit apparently works equally well without it, although this remains for each man to find out for himself after the set is put into operation.



L1,C1 is the regular tuner primary.
L2,C2 is the regular tuner secondary.
L3, C3 is the usual plate circut, from which C3 may be omitted.
C6, Phone bypass, as usual or a trifle larger.
L4, C4, L5, C5 make up the "super" part of the circuit which oscillates at a high audio frequency. This part of the circuit is described in the text.

The coupling between the plate and secondary coils should be variable. The condenser C_1 is not necessary though personally I believe it is desirable. If used it should under no circumstances have a capacity of more than 250 micromicrofarads (.00025 μfd.) which calls for eleven or thirteen plates in the ordinary condenser.

(Notice that the description so far applies to any regenerative tuner. It is therefore possible to take your present tuner and add the apparatus which is described further on.—Tech. Ed.)

The Super Circuit

Now we come to the l ng-wave circuits upon which the operation of the circuit hangs. If these circuits are not working properly the whole thing will be worthless and will operate with the same old disturbances that were troublesome in all supers of the past.

The grid coil L_4 is a duo-lateral coil of 1250 turns, which is shunted by a Dubilier type 610 mica condenser having a capacity of 1000 micromicrofarad (.001 μfd.) This value is fairly critical.

The plate coil L_5 is a duo-lateral of 1500 turns and is shunted by a Dubilier mica condenser having a capacity of 2500 micromicrofarads. This coil is so placed that the coupling between it and the coil L_4 can be varied easily from very close coupling to a right angle.

The telephone shunt condenser has a capacity of 1000 micromicrofarads. The B battery voltage should be about 45.

"Operation"

Turn on the filament and tighten the coupling between L_4 and L_5 until the oscillating point is reached and passed and the oscillations are about to stop. This point is somewhat critical and it will take a few trials to find the best place. Once it is decided upon, no further adjustment is needed. A faint high pitch hum will be heard in the phones, so faint that you have to listen for it. Now tune for signals with the usual controls of the regular tuner. With a little experience results may be somewhat improved by trying different B battery voltages and different capacities across the phones. As mentioned, the whole scheme is subject to modification. The most important consideration is not to vary greatly from the above recommendations at first, but to make your own changes afterwards when you have learned to use the circuit. The success of the whole thing seems to hinge on the extremely low frequency of the "super" oscillator.

The regenerative circuit tunes in the

regular manner and by always holding the "super" circuit at the point where it is about to stop oscillating, the writer finds that heretofore objectionable howl, squeals, and rushing noises, so common to super regenerators, are to a consderable extent eliminated.

"Results"

The results will not be very "super-regenerative'" in their characteristics. Selectivtiy seems almost as great as with an ordinary regenerative set, although at my location, 40 miles from the nearest transmitter, this has been hard to determine. I am sure, though that it is more selective than the usual super regenerator. A slight broadness of tuning is noticeable at the short waves because it helps to hang on to short wave stations which are swinging slightly.

Signals that are audible with a regular regenerative set are improved to about double their strength by this circuit, and signals that are beyond hearing with anything in the regenerative line can be heard with good audibility. The average increase in range appears to be something like 40 percent over a regenerative receiver. This is done without the usual ear-splitting noises obtained by adding an audio amplifier. As there is nothing whatever in the noise making quality of a receiver to scare one away from its use, there seem to be but two things to consider before putting such an arrangement into general use. These are selectivity and interference—by radiation. Where I am located, it is hard to determine either of these things.

I will be glad to hear from anybody interested in experimenting with a set of this kind for waves below 100 meters.

Communication with VDM

A LATE report advises that 1BIS heard VDM on July 4, 5, 7, and 10. 8DCW also reports hearing VDM on July 5 and 6. On August 25, 26, 27, Canadian 4FV worked him several times, exchanging messages while it was full daylight at Pond's Inlet, Lancaster Sound, where VDM was located at the time. Canadian 9AL, 3CO, and 3VH all tied in with some of this work, assisting when necessary. 9AL passed a message to VDM on August 28, thru heavy QRN. VDM is now using about 145 meters, instead of 120. 3AVN and Canadian 5CT report hearing him on August 27 and 26 respectively. 9DDP and 9EEG both worked "Bill" Choat on the morning of the 27th, 9EEG, by the way, using a 5-watter.

7GR managed to hook up with VDM on August 28th and reported strong signals on about 145 meters.

Sixth District Amateurs Attention

THE annual convention of the amateurs of the Sixth Radio District will be held at Modesto, California, this year on November 7th, 8th, and 9th, under the auspices of the Modesto Radio Club. The convention promises to be the biggest the Sixth District has ever seen, and with all of the things they have planned for the convention—O Boy, you just can't afford to stay away!

A big feature of the convention will be the awarding, to the best all around amateur station in the Sixth District, of a real trophy. This trophy will be a replica of the famous Wouff-Hong. It will probably be about six inches long, suspended by silver chains, and engraved each year with the call of the winning station. A committee of prominent Sixth District radio men will act as judges in awarding the prize. In order to make this memento something worth trying for, the Wouff-Hong is going to be made from the plates and grids of "shot" vacuum tubes! Every ham who has one or more burned out tubes around his shack should get busy right now and send the "innards" to Mr. L. J. Wren, 6BDS, 911 13th Street, Modesto, California, and contribute his part toward the sacred Wouff-Hong! Though this is, strictly speaking, a Sixth District affair, plates and grids coming from amateurs in other parts of the country will certainly not be refused, according to Mr. Frank Flowers, 6ST, president of the Modesto Club. The more the merrier—and the larger the resulting Wouff-Hong!

Many other things of interest are planned for the three days of the convention. Mr. K. B. Warner, Secretary of the A.R.R.L. and Mr. A. A. Hebert, Treasurer-Field Man of the League will be on hand to meet the Sixth District hams and discuss matters pertaining to League activities.

Make your reservations NOW! Write Mr. L. J. Wren, at the address above, telling him that you will be there with bells on and to save a place for you!

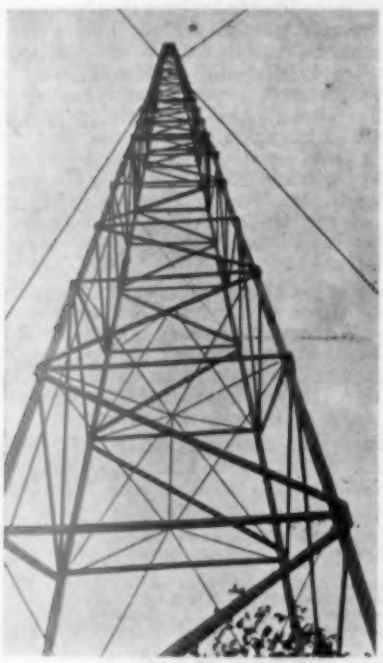
A 100-Foot Wooden Tower

By Trendall Rowe, 7AGI

THE wooden tower has a number of advantages over the straight wooden pole, chief among which are its great rigidity and strength. Few guy wires need be used, which is an advantage both in convenience and appearance. It does not obstruct the yard and does not absorb as much energy from the antenna field as does a wooden mast with more guys.

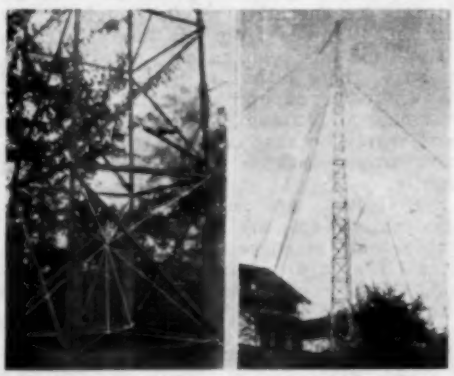
The tower at 7AGI is built on four cedar posts set on the corners of a five-foot square. The posts are four inch by four inch and are set 30 inches in concrete. The tower tapers so as to be one foot square at the top. The vertical corner timbers are two inch spruce. The base construction is of one inch by two inch clear through, as is the cross bracing.

The first cross braces are placed two feet above the ground; thereafter they are



placed every five feet up to the 42 foot level. For the next 36 feet the cross braces are spaced four feet apart, and the rest of the tower they are spaced three feet apart. The diagonal braces are fitted as the construction of the tower proceeds. The system of splicing the 2" by 2" corner pieces is shown in the drawing while the photographs explain the rest of the construction.

The tower is topped off with a 12" wooden



square into the corners of which the 2" by 2" corner pieces of the tower are fitted. This is shown in the drawing.

Material List

480	lineal	feet	2" x 2" Spruce
800	"	"	1" x 2" "
16	"	"	4" x 4" Cedar or Redwood
20	"	"	2" x 4" Fir
600	feet	#10	Galvanized iron wire
750	"	#12	" "
16	Bolts	¼" x 6"	
8	"	¾" x 7"	
36	strain-knob or egg insulators		
1	Pulley		
3	gallons Marine Paint for 2 coats		
4	guy wires for 83-ft. level		
4	" " " 50-ft. "		

Raising apparatus:
1 Gin pole 40' x 9" base and 6" top
Good ⅝" or ¾" tackle, 1 to 4 ratio

Guying and Trussing

The strength of the finished tower depends entirely upon the care with which the braces are fitted and nailed and the truss wires (internal cross wires) are adjusted. No. 10 or No. 12 galvanized iron wire can be used. The greatest care should be taken in making the truss wiring as accurate as possible.

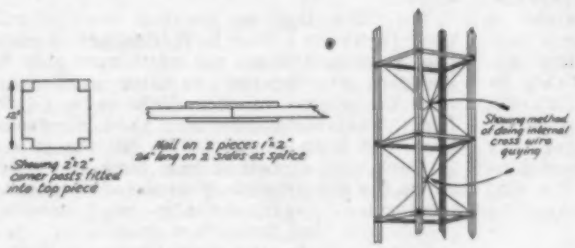
Four or eight guys may be used to hold the finished tower in place, but the writer used and prefers eight because of the greater factor of safety.

The base of the tower is further strengthened by bolting a 5 foot length of

2" by 4" lumber to the foundation post and the cornerpiece of the tower. This is shown in one of the photographs.

Raising the Tower

The tower is raised by using a 40-foot gin pole. This pole must first be erected and guyed. The way of doing this may be learned by watching a telephone line gang


Showing 2"x2" corner posts fitted into top piece
Nail on 2 pieces 1"x2" 24" long on 2 sides as splice
Showing method of doing internal cross wire guying

erecting poles. A man with pole-line experience can speed this job up very much. When the gin pole is up, two of the tower legs are bolted to the base post and lifted with these bolts acting as pivots. The gin pole must of course be so located that this can be done without excessive strains.

Shutting Down An Interference Factory

HOW would you like to live next to a large and enthusiastic spark station whose operator cheerfully "sat on the key" and let the spark run all day? Enough to make anyone see red isn't it?

Very well—that is exactly what happens to the poor chap who installs a radio receiver near one of the electrical dust-savers that are used by smelters and cement mills. The "Cottrell Precipitator" is a fine piece of engineering work—it has stopped a good many thousands of dollars from escaping up the stack—but it certainly does raise perfectly sinful radio interference in some places. If in any doubt about that one has only to ask the radio men of Tacoma, Washington, or those from Miami, Globe and Superior Arizona. Their evidence will be positive enough—also you will learn new ways of using the few cuss words that we have in the English language.

At Globe and Miami things had become intolerable and the Radio Service was appealed to. Colonel J. F. Dillon, 6th District Supervisor of Radio, came to Globe and tackled the job in his usual energetic fashion. The details are given in the "Radio Service Bulletin" (Dept. of Commerce) for June 2 and those having occasion to tackle a similar job are urged to read the account in detail. The following abbreviated account and illustration are taken from "Radio" for July.

"As similar trouble is being experienced elsewhere the accompanying diagram of connections should be of interest.

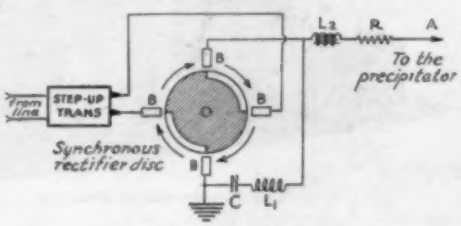
"The line A extended to the precipitator, 214 meters from the rectifier.

"A low resistance circuit L_1 was shunted across the rectifier disc and the 1500-ohm resistance in the line removed to the metal wall of the building. An iron-core choke L_2, consisting of 120 turns of wire 1½" square laminated iron core was also inserted in the line. After these changes had been made there was no further trouble."

The Radio Service Bulletin states that the manager of the plant at Superior will make an attempt to stop the trouble there by complete screening with an iron cage having one inch mesh. The results will be reported to the Supervisor.

The theory of the cure used at the Globe and Miami plants is quoted from the Bulletin as follows.

"It may be said that a great deal depends upon the character of the resistances. All radio engineers agree that the formula (for an oscilatory circuit) $2\sqrt{L/C}$ is accurate and that if R is greater than $2\sqrt{L/C}$ the circuit will be non-oscillatory. Hence if the interference is maximum at a wavelength of 300 meters with a capacity of .0035 microfards and an inductance of 10 microhenries any resistance above 126.5 ohms will render the circuit non-oscillatory



CIRCUIT USED TO "MUFFLE" COTTRELL PRECIPITATOR

B—Brushes set ⅜" from rectifier disc
C—Condenser .006 microfarad
L_1—Air-core inductance 10,000 centimeters
L_2—Iron-core choke, 120 turns wound on laminated core 1½" square

Only one phase shown altho actual installation uses three phases at 60,000 volts and 47½ cycles

and hence any additional resistance will tend to further damp out the oscillation."

The constants referred to are presumably those of the line and the precipitator.

At any rate—the 6th district supervisor has made some fast friends by a constructive piece of work.

Grebe Developments

SEVERAL recent developments by the A. H. Grebe organization offer such a variety of new departures as to deserve more attention than *QST* is accustomed to direct toward a tuner in these days of rapid changes in apparatus.

The Grebe "Synchrophase" receiver is most notable for the new departures represented by the apparatus inside the cabinet, but the first glance will probably be directed at the panel which is very different from the usual. Since Grebe first popularized the dial, it seems reasonable that they should first move again. This has been done in the "Synchrophase" by puting the dial inside the cabinet with its edge projecting thru a horizontal slot in the panel, exactly after the fashion of the well-known Grebe "tangent vernier" control. The fine control has been retained in its usual position below the main dial.

The Synchrophase Receiver

The internal arrangement of the set is characteristically Grebe but the units are new, for this is a receiver of the tuned radio amplifier type designed with special attention to removing some of the leading defects of the this type of set.

Builders of neutrodynes are familiar with the care necessary to prevent magnetic feedback between the coils in different stages of the amplifier. In the "Synchrophase" this difficulty is avoided in a different manner by making the coils of a special shape which has practically no magnetic field outside of the coil itself. This incidentally assures that the cure is permanent and will not be disturbed by the use of a loop placed so that it can pick up energy from the stage just ahead of the detector.

We think that we see the work of our good Hawkeye friend R. R. Batcher in these special coils, and we are quite sure that he designed the special variable condensers used to tune the input and the radio amplifier. Variable condensers have for some time past been one of *QST*'s pet topics and in fact our agitation has been the main cause for the present epidemic of "low loss" condensers. (Incidentally—we invented that term "low loss".)

In the new Grebe condenser another of our pet suggestions has been used—that of making the plate of a shape which will give a straight *frequency* curve instead of the straight wavelength curve which is so freely advertised. This was discussed in detail on page 27 of our September issue.

The "Clarifier"

In order to provide a radio stage for Grebe tuners previous to the "Synchrophase" there has been designed a one-step antiregenerative radio amplifier called the "Clarifier." The panel design and interior construction are uniform with the customary Grebe sets so that the addition does not in any way harm the appearance of the tuner while increasing its range and its selectivity.

Since such a stage of amplification is non-oscillating it will considerably decrease the radiation interference ordinarily caused by an oscillating detector.

It will be seen that the detector can still be made to regenerate and even to oscillate. However the detector is no longer so directly connected to the antenna and the amount of energy that can reach the antenna and cause interference is limited to that which can be fed back thru the "Clarifier." This is materially less than before, when the oscillating detector was directly connected to the antenna or closely coupled to it. For the sake of keeping the circuit simple no attempt was made to balance out the various capacity couplings that permit this remaining "reverse repeating." This would have required the methods described by Dr. Hull on page 32 of our August issue.

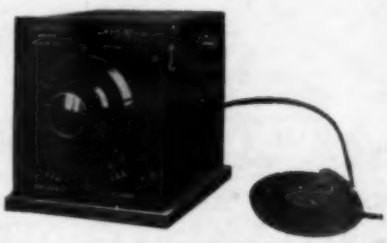
However this has nothing to do with the radio amplification, which is a definite improvement, when used in the broadcast range.

The Clarifier circuit, shown in Fig. 1, will be recognized as an old friend. The interior arrangement is shown in Fig. 2.

For the sake of those who wish to add such a device to their sets the following description is abstracted from an article by Mr. R. R. Batcher, Research Engineer for A. H. Grebe, Inc.

The input coil, to which the antenna is connected, is wound on a 2" tube as shown in Fig. 3. The sort of insulation on the wire does not matter much. For a tuning range of 215 to 590 meters the coil should be tapped as shown. The part above the tap is mounted by a variable condenser with a capacity of 400 micromicrofarads. Since this is a special size a standard well-made 500 micromicrofarad (.0005 μfd.) condenser may be substituted.

The adjustable stablizing condenser is seen in Fig. 4. It is quite easy to convert



The Clarifier

a glass-encased grid leak into such a condenser.

If the metal ends of the leak are heated slightly they will come off as they are generally fastened with Woods metal. The grid leak element is then removed and one cap is replaced on an end. A small piece of cardboard is then cut to fit the tube as shown in Figure 4. A small quantity of Woods metal or other low melting alloy is then melted and poured in the glass tube on one side of the cardboard strip. This will form a semicircular rod, firmly soldered to the cap on the lower end and extending nearly the full length of the tube. A small brass trough, semicircular in cross-section, is soldered to the other cap.

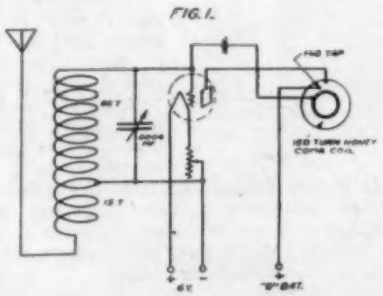
When completed, a small variable condenser with a glass dielectric is obtained which can be readily mounted by means of the grid leak mounting clips. One of the caps should be soldered to a clip as shown in Fig. 3. The other cap on the glass tube is then free to rotate, furnishing a means for varying the capacity.

This condenser should be readily accessible from the top of the cabinet, but need not be on the front of the panel because when it is once set the capacity need not be varied unless the type of tube used is changed.

The Output Coil

The regular Grebe output coil is rather difficult to reproduce but a simple substitute may be made of a 150 turn "honeycomb"

FIG. 1.



coil removed from its mounting and tapped by pulling out the 75th turn so that a flexible lead can be soldered to it. Another possible type of coil consists of 80 turns wound on a "spiderweb" frame of the usual sort with the tap at the 40th turn. A good coil may be made by winding two wires in parallel in the spiderweb form, connecting the outer end of one winding to the inner end of the other. This is the mid-tap and the single flexible lead is soldered to it. This lead goes to the positive terminal of the B battery. In addition a two-conductor flexible coil is used to connect the coil to the plate of the tube and to the compensating condenser as shown in Fig. 1.

Operation

The output coil may be laid on top of the receiving set or inside the cabinet, wherever

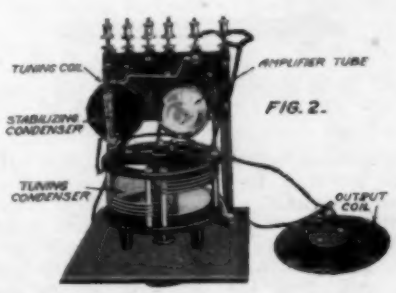


FIG. 2.

it will be nearest the grid coil of the detector tube.

It is to be noted that no ground connections are necessary on this unit, since

the regular ground is to be left on the receiver itself. The antenna is disconnected from the receiver and connected to this circuit. The antenna and ground binding posts on the receiver are to be connected together on single circuit receivers. On double circuit receivers these posts may be connected together also, if it is found by experiment that there is an improvement by so doing.

FIG. 3

It remains to be shown how the balanced output circuit of this tube is adjusted and how the "clairfier" is to be used in practical cases. After the connections have been made to this device, the tube is turned on to normal brilliancy. The receiving set is adjusted to a low wavelength, such as about 300 meters, and a pair of receivers or loud speaker connected as usual. If a single circuit receiver is used the antenna and ground binding posts are connected together. The balance in the radio frequency tube is obtained by adjusting the small variable condenser. This adjustment can be made in several ways.

Set the receiver dials to receive signals from some broadcasting station. When the

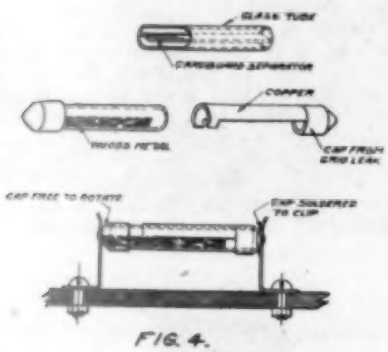


FIG. 4.

tuning condenser is swung around it will, at some position, be in tune also with the incoming signals. If the "clarifier" tube is oscillating, the pitch of the notes received will change as its tuning condenser is swung in and out of tune. If this tube is not oscillating the intensity of the signal will change, but not the pitch. Since it is desired to stop all oscillations in this tube, the small stabilizing condenser is adjusted until the intensity only is changed when the tuning condenser is varied.

The Delta Division Convention

MEMPHIS! oh Memphis! where was thy sting with the thermometer at 102 during those memorable days, August 27th, 28th and 29th, when one W. W. Rodgers, Division Manager, did put over a 100% Convention? Fifty seven "hams" were present from Louisiana, Alabama, Mississippi, Arkansas and Tennessee; as a matter of fact all Districts excepting third, sixth and seventh were represented.

Being a convention "hound," one wonders why each convention seems to run as smoothly as any of the old ones and it is assumed that the reason is just due to all having a common interest and working towards one end—success. From the time of the first registration until the last minute there was not an instant but something was doing. We did enjoy the stunts, particularly the spoon race, where the participants had to run sixty feet carrying in a spoon honest-to-goodness 199, 200 and 201-A tubes; only acrobats were able to win and if recollection is good most of the Memphis gang were winners. This also explains why we found such fine aerials, some 75 feet and 80 feet, just as straight as arrows, and those that put them up must have been expert climbers; and say, we must not forget the fine stations. Honest, all those visited could take a prize in a contest, and they can handle traffic as well.

Fred Schnell, the one who lords it over the destiny of the Traffic Department, talked for two hours on short waves and comprehensively explained how it can be done; that "hay-wire" short wave-tuner of his created a lot of interest too. Treasurer Hebert showed us how to make a simple wave-meter to cover the range of short waves.

The Hotel Gayoso where the banquet took place did itself proud by serving food that was a pleasure to eat. At the speakers table were noted Radio Supervisor Deiler with his assistant Inspector duTreil, B. F. painter, Director from the Delta Division; Dr. Hunter, A.D.M. for Arkansas; Bradford Hearn, that efficient representative of the Publicity Department from Shreveport, La. Schnell and Hebert could be seen in deep conversation with their neighbors, and all those called upon to speak said a few pertinent words.

But the climax of the Convention, on the last day, was the R.O.W.H. initiation. We have seen four of them, but none equalled this setting and the acting was good. All thanks to W. W. Rodgers and his brother O.S. for the success.

—*A.A.H.*

The Transmitter at 6CHX

By Robert E. Geddes, 6CHX

THERE is always a great demand for a circuit that will give good results on low power C.W. without difficult adjustment. The principle of the circuit which will be described in this article is not new but as far as I know the circuit is used only by a few stations in San Diego, California. The circuit is another modified Hartley. Just as the ordinary "grid tickler" (also called "1DH" or "Sure-fire") is a Hartley circuit in which the *grid* coil has been made separate so this is a circuit in which the *plate* coil is separate. It therefore seems reasonable to speak of it as a "plate tickler circuit." It really resembles the old single circuit tuner as much as anything, and that is enough comment on the transmitting ability of the single circuit tuner. In fact the use of this circuit for transmission was suggested to me by a terrific squawk from a single circuit receiver next door. If this thing was so good a transmitter when it used a receiving tube, why would it not be still better when it is used as a transmitting tube?

A couple of oats boxes were emptied and wire hastily wrapped around them. Inside of fifteen minutes 6CHX was on the air for the first time. This strange concoction worked 20 miles.

Bit by bit good apparatus replaced junk and eventually the station began to do really nice work with a newly purchased 5-watter.

Materials

It is an absolute necessity to use good material in building this or any other set, if satisfactory results are to be expected. For the benefit of those who want everything just as it is here, the following list of apparatus is given but there is no reason for sticking to these particular makes.

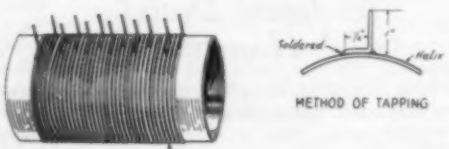


FIG. 1

1—5000-ohm Radio Corp. transmitting grid leak.
1—.002 microfarad Faradon transmitting grid condenser.
1—Filament rheostat.
1—Porcelain socket.
1—C-302 tube.
4—1 microfarad filter condensers.
2—1½ henry chokes (4 is better).
1—cardboard tube 5¼ inches in diameter (or thereabouts).
1—cardboard tube 5 inches in diameter (approximately).
21 feet—No. 12 bare copper wire.

Construction

The antenna inductance consists of a 5¼-inch or 5⅜-inch cardboard tube dipped into hot paraffin and then wound with 15 turns of No. 12 bare copper wire. A common chalk line or fish line is wound on with the wire. This lies between the turns of wire and spaces them apart. The cord should be about the same size as the wire. Each turn of the coil has a bent tap soldered to it as shown in Figure 1. (In doing this it is absolutely necessary to solder with rosin as the string will soak up the soldering compound. Acids or pastes will *positively make trouble* in the coil but the rosin is harmless unless it has been scorched by having the soldering copper too hot.—Tech. Ed.)

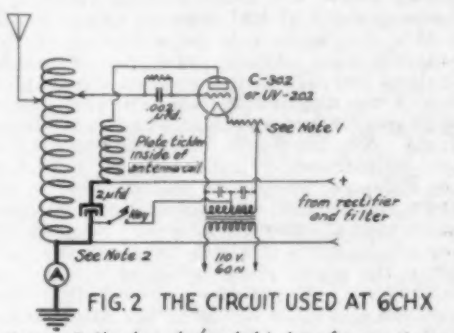


FIG. 2 THE CIRCUIT USED AT 6CHX

NOTE 1 *Better to put rheostat in transformer primary see page 54, December 1923 QST*

NOTE 2 *Keep the heavy leads short.*

The plate tickler is composed of 20 turns of No. 16 double cotton-covered wire spaced one inch apart and wound on a cardboard tube 5 inches in diameter. This coil is dipped in hot paraffin in the same fashion as the antenna coil.

The coils should be wound in opposite directions. If a mistake is made the connections of the plate tickler may be reversed but the results will not be as good.

Careful mounting of the grid leak and condenser on bakelite or hard rubber will pay in the long run.

Adjusting

Begin by laying the antenna coil down

with the plate tickler inside of it. Then put the antenna clip say 3 taps from the free end of the antenna coil. The filament ground and also the negative high voltage leads are soldered together and a lead from them is soldered to the one end of the antenna coil. A separate tap for the filament was at one time necessary but experiments have shown that it always works best at the place just given.

When tuning the set use a low voltage; 350 is a good starter. When you have the circuit adjusted you can "slap on more sap."

The position of the grid clip will be by far the most critical to adjust and considerable experimentation may have to be done to find its proper location. It has been found that when four or more wires are used in the antenna the grid clip may have to be placed below the antenna clip. With antenna systems of less capacity the grid will nearly always have to be placed above the antenna clip. As the grid clip is moved further away from the antenna clip (up or down) the antenna current will rise slowly until you come to a turn at which it suddenly drops. The turn just inside that one is the best adjustment. When this point is reached the antenna clip may be moved either up or down to change the wavelength without much need of other adjustment. Some shifting of the plate coil may be necessary, but after the right place is found it may be left alone. Experience showed that the antenna clip could be put as far down as the fifth turn, using four grid turns. The circuit oscillated nearly as strongly as ever. Thus by a *mere shifting of the antenna clip*, the wavelength was changed from 198 to

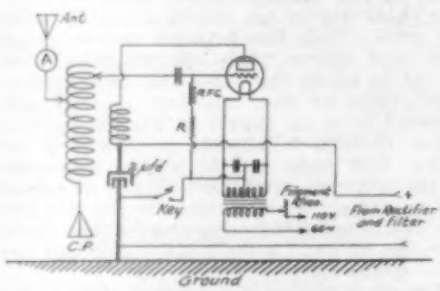


FIG. 3 WHEN USING A COUNTERPOISE

A plate tickler circuit suggested by Ballantine which does not make any nodal point trouble.

R.F.C. 150 turns of wire smaller than No. 30 wound on ½ or ¾ inch rod or tube. R. – Regular grid leak.

about 160 meters while the antenna current changed only .2. If the set absolutely refuses to oscillate try reversing the leads to the plate tickler.

Voltage

At 6CHX I found that putting on more than 600 volts D.C. caused fading, gave a ragged note and did not help the range a particle, although the plate got hotter and the antenna ammeter went over further. After long transmission with 600 volts, the plates of the single C-202 tube turned a dull red. The antenna current was 1.4 amperes. The "ampere hounds" will howl at this but I am a firm believer in "the

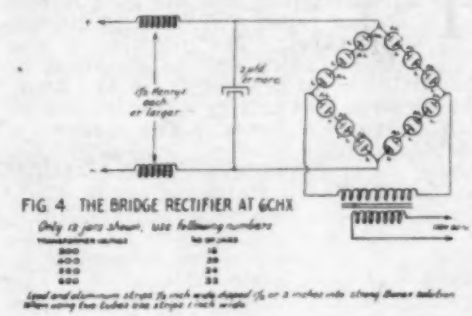


FIG. 4 THE BRIDGE RECTIFIER AT 6CHX

Only 12 jars shown, use following numbers

300	16
400	20
500	24
600	30

Lead and aluminum strips ½ inch wide tinned (⅛ or 3 inches into strong Borax solution when using two tubes use strips 1 inch wide

antenna current does not mean much." Our conditions at San Diego are not good at all. We are greatly handicapped by the 200-kilowatt arc station (NPL) within 2½ miles of us. However it was possible during March, April and May to work a number of stations outside of the Sixth District, to work 5PS at 1200 miles and to reach southward far enough so that the signals were copied at Balboa, Panama, a distance of 2936 miles. Working in the same fashion another San Diego station has been heard in Australia and Alaska. This is certainly proof that range can be gotten from these small tubes without abusing them.

If anyone has any trouble with the circuit I shall be only too glad to help them. Just drop a line to 6CHX, care Robert E. Geddes, 3720 Georgia St., San Diego, California. *Please* enclose the customary stamped envelope OM.

Midwest Division Hamfest

FORTY enthusiastic amateurs of the Midwest division attended the banquet held under the auspices of the Citizen Radio Club of Omaha on August 9th at the Conant Hotel. Amateurs from Kansas City, Maryville, Mo., Atchison, Kan., Lincoln and Seward, Nebr. were among the out of town visitors present. This was the first amateur get-to-gether ever held in Omaha and the friendships made over the air and between the members of the Ole' Midwest was considerably strengthened at this little meet.

Mr. P. H. Quinby, 9DXY, Midwest Division Manager, was toastmaster for the eve-

ning. The distinguished speaker of the occasion was L. B. Laizure of Kansas City, Mo., Midwest director who broke the much looked for news of his first director's meeting in Hartford. Mr. Laizure gave an interesting account of the meeting and brought us news that made the heart of every amateur there very joyful. Musical entertainment was provided by a super-het with a loud speaker attachment which tuned in the local broadcasting stations.

The stunts, held after the serving of the dinner, were the feature of the banquet and much hilarity was caused by the radio liar's contest and the several wild yarns heard.

More Pan-American Tests

THE amateurs of the countries of South America are so enthused over the success of the May Pan-American Tests that the Radio Club of Argentine has asked the A.R.R.L to arrange another series of tests for October.

Because of the unexpectedness of the request, it was not possible to make a preliminary announcement last month, but we hope the "gang" will "turn to" and poke some signals down south and establish two-way communication. Since the last tests the countries of South America have relaxed their regulations governing amateur transmission and many amateurs now hold licenses and are bubbling over with an eagerness to establish reliable communication—so, fellows, let's do our part.

Now here's what we propose to the South American amateurs and our members:

Dates of the tests, October 14th and 24th, inclusive.

South American amateurs will transmit daily from 11:30 P.M. to midnite, E.S.T., on wavelengths between 80 and 110 meters.

American and Canadian amateurs will transmit from midnite to 12:30 A.M., E.S.T.

Code words may be used—you make up your own code and keep a record of it in your log—and be sure to keep an accurate log of your transmission and reception, forwarding a copy to A.R.R.L. Headquarters for verification.

Beginning at 12:30 A.M., E.S.T., attempts at two-way communication may be undertaken. We suggest the waves between 75 and 80 meters as being the most desirable from all standpoints.

—*F.H.S.*

Don't Miss the November Issue

QST Leads Again

MR. J. L. McLaughlin, designer of the One-Control Neutrodyne, has "rung the bell" again. We are proud to announce that the November issue will contain a complete description, with constructional details and values, of the

ONE-CONTROL SUPER-HETERODYNE

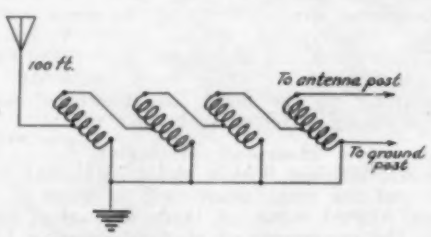
which he has designed. We consider it the greatest advance of recent years in superheterodyne construction. No, *QST* still costs only two dollars per year or twenty cents the copy.

A Static Reducer

By Dr. Jack Rodgers

FOR several years I have used a static drain coil system on all types of receivers, except crystal sets with which I have never experimented. The coils are arranged as shown in the figure, at an angle of 55 degrees. For the broadcasting range all of the coils have 66 turns of No. 24 wire on 3½ inch tube. The tap is taken at the middle or 33rd turn. With a regenerative receiver three coils may be used without too much loss of signal strength. Four to six can be used with a superheterodyne.

When used with a superheterodyne having good selectivity on both dials, stations 500 to 700 miles away can be received through local lightning. It is important that the proper amount of amplification be used. If too much is used the coils act as



STATIC DRAIN COIL SYSTEM

loop aerials and if too little is used you do not hear the station.

Don't ask me how the signal gets thru the coils, *but it certainly does.*

Experimenters Section Report

MEMBERSHIP in the Section is open to anyone interested in radio experimentation in company with others.

It is not necessary to have a radio laboratory, most of the work can be done with the equipment of an ordinary amateur station plus the willingness to stick to it.

Joining the Section

The business of joining the section is extremely simple—just address a request to *Experimenter's Section, A.R.R.L., 1045 Main Street, Hartford, Conn.*

The Service of the Section

The Experimenter's Section offers the following services:

A list of men who are interested in your problem.

A list of problems that are in need of work at present.

Outlines suggesting the best way of attacking your problem.

All of these are kept up to date and are available on request of those who have enrolled their names in the Section.

Laboratory Sheets

Several additional laboratory sheets have been made out. They will be mimeographed and sent to the members who signed up for them as soon as the next *QST* copy can be gotten out of the way.

New Numbers for Experiments

It has been necessary to re-number the experiments. The corrected list was given on page 33 last month. Please take note and use the new numbers in your correspondence.

Our Membership Lists

A revised list of the membership of the section, arranged by problems, has just been mailed out.

Why We Are Delayed

Our promise to send out additional outlines has not been made good. A rather disastrous fire occurred at the place where the Department Editor and Technical Editor lived and destroyed 1OA-1ID-1AEL (see "Strays"). The work incidental to cleaning up the mess has interfered with everything. Better luck next month.

"Harmonic Factories"

Mr. William Schick, radio 2MU, has continued the work mentioned on page 36 of our August issue. A large amount of data on the equipment of stations causing harmonic interference has been gathered and at present it seems that the general use of inductively coupled circuits would very greatly improve matters.

More complete results will be presented later. If interested in this problem by all means communicate with 2MU as he is having a rather lonesome time of it, altho coming along steadily.

Boy Scouts

What is the attitude of this section with regard to an affiliation, purely informally, between A.R.R.L. and the boy Scouts of America? Such an alliance will amount to little more than an agreement to work together when opportunities offer—to help radio in Scouting and in return to interest younger members for A.R.R.L. What are your opinions?

The Barometer

Robert Amsbury, 6CIX, of 317 N. Friends Ave., Whittier, California, is making records of the variation of transmission with changes in the barometer.

High Speed (Audio) Fading

High speed, or audio frequency fading has received much attention of late because it is almost universal below 100 meters. Many amateur stations, also KDKA, WGY, and 9XW, have been accused of using 25-cycle plate supply when they were actually using very good D.C. It must be admitted that at times the best of them sound as if a commutator bar was missing entirely.

Records of this fading are being made by a new method and more observers may be wanted later. There is no intention of making this a "free for all" such as the A.R.R.L.-Bureau of Standards tests were, partly because the apparatus must be purchased and partly because the records are so much better that fewer observations are needed for useful results.

Those interested are requested to write this section in the usual form which is noted at the close of this report.

Urgent Problems

Immediate information is needed on the designs which will give lowest losses in apparatus used at 4, 20 and 40 meters. This includes transmission helices and condensers, also receiving coils and sockets—if the latter should be used at all which is doubtful. It is mainly a matter of dimensions, it is a foregone conclusion that the wire should be solid and that the insulation should be air, pyrex or porcelain, with paraffined wood and cardboard as next best. Actual test and measurement—not mere opinion—are needed.

Observers for NAA

Careful observers who can receive 15 words per minute are wanted for some observations to be made on the transmission of NAA and possibly some other stations. The wavelength is 2650 meters, the signal I.C.W.

Please communicate direct with this section in the regular form indicated below.

Concerning Meters

No member of this section can fail to gain useful information from the catalogues of meter makers such as Weston, Roller-Smith, Jewell, Westinghouse, General Electric, Rawson, and General Radio. Even long use of meters leaves one with plenty of room for more meter information. Particular attention is invited to the new Roller-Smith portable alternating current meters described in their bulletin 160, and to the Jewell tube test set whose use is on the increase since the superheterodyne has come back into use.

Ballantine Observers

Some special transmisison experiments will be run this fall or winter by our good friend Stuart Ballantine. Observers are needed for a problem that promises to illuminate transmission difficulties very considererably. Please communicate with this section direct in the regular way. By all means please do not burden Mr. Ballantine with correspondence.

Correspondence

It has become absolutely necessary to insist that letters to this section be made separate and that they be kept free of matters relating to *QST*, the Information Service and the Traffic Department. Please put such things in another letter addressed to the proper department. Neglect of this causes great delay.

Please address your communication to "Experimenters Section, A.R.R.L., 1045 Main Street, Hartford, Connecticut," and enclose a stamped, and self addressed envelope for reply. Foreign members in particular are requested to supply the return envelope but the stamp is not necessary in such cases.

Those Moonlight Effects

Frankly, we have been much disappointed in the small response regarding Moonlight Effects on radio transmission.

One good response has been obtained, however, from Mr. John F. Langmaid, Jr., of station 1AFS. He has made the test with station 1PP. Comments as follows:

"I was very much surprised to see that during full moon there was no static as I had made some tests and found that during full moon the static was very bad, where with no moon there was very little static. These tests were made at Northwood, New Hampshire. The signal strengths were about the same. These tests were held about July 14 or 15, 1924, and during August, 1923, on amateur waves."

It is possible that the disagreement is due to a difference in wavelengths. Will not someone follow this up?

Inductance Standards

Anyone who has occasion to do work where accurate information on wavelengths, capacity, or inductance is necessary really needs some coils of known inductance. Just how to build them is a puzzle.

For this reason there has been written a very beautiful little report by J. L. Preston and M. S. Strock, respectively Physicist and Assistant Physicist of the Bureau of Standards. The paper is known as Letter Circular No. 103 and may be obtained by writing the Radio Section, Bureau of Standards, Washington, D.C. It gives full specifications with several excellent illustrations for the construction of standard inductance coils from 8 microhenries to 5000 microhenries, 17 types being given all together.

By all means get a copy.

First Vermont State Convention

ON August 9, about fifty hams, OM's and YL's, from five districts gathered at Poultney, Vt. to attend the first Vermont State A.R.R.L. Convention, which was held under the direction of the Poultney Executive Radio Council, affiliated. The morning and early part of the afternoon were devoted to visiting local stations, hamfesting, etc. A. A. Hebert addressed the Technical Meeting and told how to get our transmitters down to the low wave lengths. Mr. Hebert also told how to make an excellent wave meter at low cost. The Traffic Meeting was in charge of W. M. Hall, A.D.M. for Vermont. After his talk a general discussion of affairs in Vermont ensued.

An excellent banquet was served and after the eats had been disposed of, George Wood, Jr., President of the P.E.R.C., gave an address of welcome. C. Roddy, 8DMT, then gave a very interesting talk, telling of his experiences in the British Navy and commercial service as radio operator. W. F. Moore, 1APU, told of his radio experiences in the U.S. Army and showed how the amateur can help his country in time of need. A. Reid, c2BE, conveyed Canada's greetings to the convention. Charles Kibling, 1BIQ, told how to make money as a commercial operator and showed the relation between commercial and amateur operators. Mr. A. A. Hebert, A.R.R.L Treasurer and Field Secretary, was the chief speaker of the evening. He gave a very interesting and valuable talk on "Our A.R.R.L." Vermont promises to send a man to the International Amateur Radio Union Congress in Paris next year.

The Vacuum Tube Voltmeter

Measuring High Voltage at Any Frequency

By J. H. Turnbull*

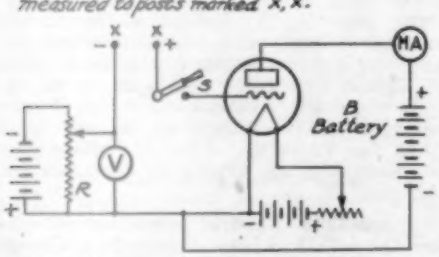
MUCH of the work in radio employs high voltages at radio or commercial frequencies. In order to know what we are doing we should be able to measure these voltages as well as the high direct voltages sometimes applied to transmitting tubes.

Ordinary direct-current meters change their scales (ranges) by adding series resistance. This has the disadvantage that the power lost in the measuring instrument and the "multiplier" resistance goes up with the voltage.

Ordinary alternating-current meters are made useful at different voltages by connecting them to the secondaries of step-down "potential transformers" whose primaries are connected to the circuits to be measured. Still these transformers are power-consuming devices.

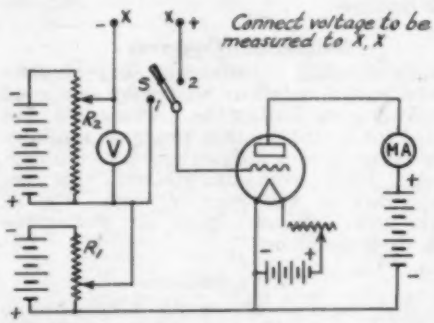
The Heising Vacuum Voltmeter

The three-element vacuum tube can be used as a means of measuring very high potentials of *any* frequency and *without consuming power*. In the system known as the "Heising Voltmeter" both the voltage to be measured and the "balancing voltage" are connected into the grid circuit of a vacuum tube as shown in Fig. 1. Now with the potentiometer the grid bias is adjusted until the plate current is not changed at all by opening and closing the switch S. This shows that the biasing voltage is the same as the voltage to be measured. This method is difficult to handle.[1]



Adjust slider on R until current thru MA does not change when the switch S is opened and closed. Then voltage shown by V is same as voltage to be measured.

FIG. 1 HEISING VOLTMETER FOR LOW VOLTAGES.



Put switch on point 1 and run slider of R_1 up until MA just barely drops back to zero. Now put switch on point 2 and run slider on R_2 up until plate current again just drops to zero. Now voltmeter V shows the unknown voltage.

FIG. 2 A ZERO-PLATE-CURRENT METHOD

Another Grid-Circuit Method

A method which is much easier to handle is to balance out the effect of the plate voltage with a negative grid bias and then to put both the unknown voltage and the balancing voltage into the grid circuit in series with the first biasing voltage. See Fig. 2. This method has the advantage that we need only determine the adjustment that gives zero plate current. This can be done more easily than the measurement of Fig. 1, and any galvanometer will do.

The methods now to be suggested are especially useful for the average amateur. (These methods can be used at high voltages without any special apparatus or large batteries.—Tech. Ed.)

An ordinary D.C. voltmeter, which preferably should read up to 150 volts, is needed, as is a milliammeter or a galvanometer and a *well insulated*[2] tube with as high an amplification constant as possible.

---

*Late of Union College, Schenectady; Experimenters Section, A.R.R.L.

1—This method takes very careful work. Every part of the apparatus must be very carefully insulated and the slightest layer of moisture may easily spoil the results. The next method is also to be used with some care.

2—A well-insulated tube is one that never has had its stem damaged by over-voltage or overheating. If there are any dark places in the "mash" at the top of the stem the tube probably will not do.

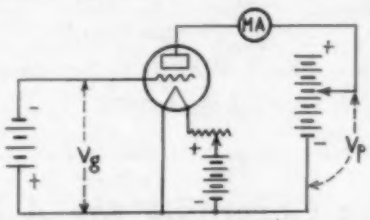
Method for Higher Voltages

The method makes use of the property of the tube called the "amplification constant" or "μ". A small *negative* voltage on the grid of a tube will prevent a much larger *positive* voltage on the plate from driving any current thru the tube. When the negative grid voltage is *just* high enough to stop the plate current we say that the "amplification constant" of the tube is the ratio of the plate voltage over the grid voltage, or

$$\mu = \frac{\text{Positive voltage connected to the plate of the tube}}{\text{Negative voltage that will bias the grid enough to stop plate current.}}$$

This ratio holds for both D.C. and A.C. with less than 1% variation over a wide range of voltages and frequencies.

We will first find the amplification con-



When V_g is just high enough to stop the plate current, $\mu = \frac{V_p}{V_g}$

FIG. 3 FINDING THE AMPLIFICATION CONSTANT μ

stant of our tube. We will select a tube with good insulation[3] and mount it in a good socket, preferably porcelain. We will connect the negative end of a B battery to the negative end of the filament and the positive end of the battery to the plate of the tube thru an indicating instrument, such as a milliammeter or galvanometer. Another B battery is connected with its *negative* end to the grid as shown in Fig.

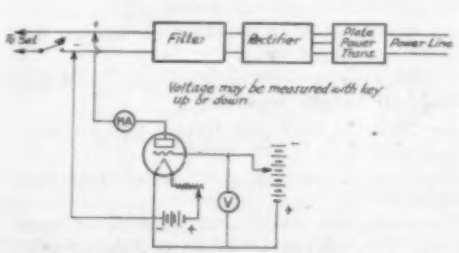


FIG. 4 MEASURING PLATE VOLTAGE OF SENDING SET

3. Now we will light our tube to the desired brightness. The milliammeter (or galvanometer) MA should show some deflection. If it does not, raise the plate

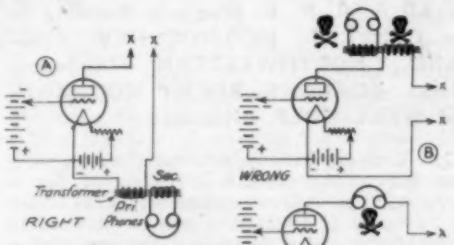
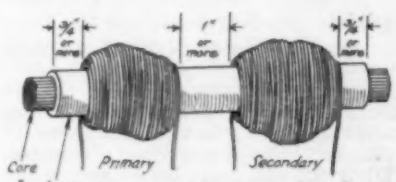


FIG. 5 MEASURING WITHOUT A MILLIAMETER OR GALVANOMETER GOOD FOR A.C., PARTLY FILTERED R.A.C OR UNFILTERED GENERATOR

voltage. The plate voltage is now cut down in as small steps as possible until the plate current *just* disappears. Now with the voltmeter measure the voltage V_g and V_p as shown in the Fig. 3 and divide V_p/V_g to get the amplification constant as explained above. (The results are much better if the voltmeter is left connected at V_g while balancing and then moved to the plate circuit.—Tech. Ed.)

Using the Amplification Constant

Now that we know the amplification constant of our tube we may measure the peak (highest) value of any voltage that will not flash across from plate to filament. This is done by connecting the voltage to



Windings each see turns of almost any small wire. Be sure to leave at least twice as much space between windings as plate voltage can possibly jump. 1" may not be enough. Core may be from an old spark coil but an iron rod will do in a pinch. Insulation may be empire cloth, glass, bakelite or rubber. Each time before using test with full plate voltage between each winding and core—it is better to burn it out than to have the plate voltage reach the headset a bit later.

FIG. 6 SIMPLE INSULATING TRANSFORMER

be measured across the plate and filament and then balancing out the plate current exactly as we have done in Fig. 2 and 3. The plate voltage is then the grid bias times the amplification constant. It will be evident to all that in these systems *we are not drawing any current* so that our

(Concluded on page 56)

ELECTION NOTICE

To All A. R. R. L. Members Residing in the CENTRAL, HUDSON, NEW ENGLAND, NORTHWESTERN (including Alaska, ROANOKE, ROCKY MOUNTAIN and WEST GULF Divisions:

1. You are hereby notified that an election for a new A.R.R.L. Director, for a term of two years commencing at noon on January 1, 1925, is about to be held in each of the above Divisions, in accordance with the Constitution and By-Laws of the League. Your attention is invited to Sec. 1 of Article IV of the Constitution, providing for the government of A.R.R.L. affairs by a Board of Directors; Sec. 2 of Article IV, defining their eligibility, and By-Laws 12, 13, 14 and 15, providing for their nomination and election.

2. Nomination petitions are hereby solicited. Ten or more A.R.R.L. members living in any Division have the privilege of nominating any member of the League in their Division as a candidate for Director. The following form in nominating is suggested:

(Place and date)

Executive Committee,
A.R.R.L. Headquarters,
Hartford, Conn.

Gentlemen:

*We, the undersigned members of the A.R.R.L. residing in the*_____ *Division, hereby nominate*_____ _____*of* _____ *as a candidate for Director from the Division, for the election of November, 1924.*

(Signatures)

The signers must be League members in good standing. The nominee must be a League member in good standing, a resident of that Division, and must be without commercial radio connections. His complete name and address should be given. All such petitions must be filed at the headquarters office of the League in Hartford, Conn., by noon of the first day of November, 1924. There is no limit on the number of petitions that may be filed.

3. The Directors at present representing the above Divisions are as follows:

Central....C. E. Darr, 8ZZ, Detroit, Mich.
Hudson .....None
New England.....G. H. Pinney, 1CKP, So. Manchester, Conn.
Northwestern....K. W. Weingarten, 7BC, Tacoma, Wash.
Roanoke.....W. T. Gravely, 3BZ, Danville, Va.
Rocky Mountain.....P. M. Segal, 9EEA, Denver, Colo.
West Gulf.....F. M. Corlett, 5ZC, Dallas, Tex.

4. The elections will take place during the month of November, on ballots which will be mailed from Headquarters in the first week of that month. The ballots for each Division will list the names of all eligible candidates nominated for the position by members residing in that Division. In the event there is but one eligible nominee from any Division, the Executive Committee will declare him elected without ballot and so notify all members of that Division.

5. The Constitution of the League is designed to insure popular and representative government. Members are urged to participate actively in the selection of their Director and to file nominating petitions immediately.

For the Board:

K. B. WARNER, Secretary.

Hartford, Conn., Aug. 1, 1924.

Rules Governing the A.R.R.L. Information Service

1.—This service is strictly limited to A.R.R.L. members in good standing.

2—Before writing, search your files of *QST*. You will probably find the answer there.

3—Do not ask for comparisons between advertised products.

4—Be reasonable in the number and kind of questions you ask.

5—Put questions in the following form:

A—A *standard business size* stamped, self-addressed envelope must be enclosed. Foreign members please omit stamp but send self-addressed envelope.

B—Write with typewriter or ink on one side of the sheet only.

C—Make diagrams on separate sheet and fasten all sheets together.

D—Number each paragraph and put only one question in a paragraph.

E—Keep a copy of your letter and your diagrams.

F—Put your name and address on each sheet. *We can not spend time digging your address out of the callbook.*

G—Address all questions to Information Service, American Radio Relay League, 1045 Main Street, Hartford, Connecticut.

Antenna Resistances

*By A. Hoyt Taylor**

A HIGH-POWER radio station operating on low frequencies even when provided with what is commonly called a very efficient antenna, actually radiates into space only a very small percent of the input energy. An amateur station operating at very high frequencies is quite capable of radiating into space an amount of energy which would compare very favorably with that radiated by a 50-kilowatt arc operated at low frequencies. The following comments on antenna resistance and radiation at high frequencies may help to make it clear why high frequencies are so efficient in certain forms of radio communication. It can readily be understood that if the high frequencies which can be so efficiently radiated are able to travel in such a way as to encounter relatively little absorption they may be used to bridge very great distances efficiently. There is no doubt in my own mind that the high frequencies do follow a transmission law utterly different from that of the lower frequencies, but that is again another story apart from the purpose of this article which aims only to make a little clearer the way in which the higher frequencies get their start in the ether with such remarkable intensity.

The resistance of an antenna may be defined as that resistance which when multiplied by the square of the antenna current gives the power actually put into the antenna by the set. This is at least a commonly accepted definition, but it is very ambiguous. Everything depends upon where the antenna current is measured, particularly when operating below the fundamental of the antenna.

The antenna current may be defined if desired, as the maximum value of the current, that is, the current at the anti-node of the system. This definition removes the ambiguity, but leaves us practically in an uncomfortable position, because it is not always convenient to locate a meter at the anti-node of current and even if they were so located, this point may under certain conditions be a good many feet above the base of the antenna, requiring a telescope to read that meter.

From a practical point of view the ideal place for a meter is in the lead to ground or counterpoise, but at high frequencies this leads to erroneous results because of the distributed capacity of the coils, condensers, etc., of the transmitter itself; that is, part of the current thus read spends itself, so to speak, in charging these coils and condensers, and being nearly 90 degrees out of phase with the driving electromotive force, represents very little power and no active radiation. When operating at low frequencies, placing the meter in the ground or counterpoise lead introduces a fairly small error because this charging current is proportional to the frequency, but when operating at high frequencies, and especially at very high frequencies, this Laboratory has adopted as standard a different method of connecting the radiation ammeter, namely, directly in series with the antenna—that is, at the top side of the transmitting set. This means, of course, that the case of the instrument has to be insulated and that the use of thermocouples with indicating instruments remote from the set is out of the question. By so locating the meter, however, it reads only the current which actually goes into the antenna and is active in producing signals at a distant point.

If we assume that the most practical place for the meter for very high frequency readings is directly in series with the antenna lead, it is obviously in many cases not at the anti-node of the system. In other words, the actual watts radiated by the antenna may be very high with only a small reading in the meter thus placed, and a situation can even arise when this meter will show almost zero reading and yet the antenna will be radiating very efficiently indeed.

Suppose we consider a straight vertical-wire antenna being operated at frequencies between three thousand and six thousand kilocycles. Suppose this antenna is long enough to be operated at a frequency considerably above its fundamental frequency. The antenna tuning coil of the set will be connected on one side to the ground or counterpoise and at the other side to a condenser (generally variable) and thence through the meter to the base of the antenna. On very high frequencies this condenser may assume extremely small values and the current through it therefore will be very small, as measured by the meter. As an extreme case, suppose that the vertical antenna is almost one-half a wavelength long. In this case there will be a maximum potential at the top of the antenna, a node in the middle and a high potential point again at the bottom. The current would be at maximum in the middle, zero at the top, and almost zero at the bottom. There will be just enough capacity added at the bottom to properly couple the energy of the set to the antenna and to bring said antenna to a condition of resonance corre-

*Superintendent, Radio Division, U.S. Naval Laboratory, Bellevue, D.C.

sponding to one-half a wavelength. The meter at the bottom might read a few hundredths of an ampere, whereas another meter located half-way up might read 1 or 2 amperes. Such a condition as this has actually been duplicated at this Laboratory and stations more than two hundred miles distant have been worked and in one case nearly 1,000 miles distant with almost no visible current in the base of the antenna; nevertheless the performance of the set itself indicates that it was delivering at least 20 watts into the antenna system.

Since for practical reasons it is well to measure the antenna current at the base of the antenna, it is recommended that the antenna resistance be thought of as an effective resistance which when multiplied by the square of the antenna current gives the indication of the power of the antenna. Similarly we will have to introduce the term "effective radiation resistance" as representing that portion of the antenna resistance which is actually useful in throwing off radiation. Theoretically, there will be no upper or lower limits to either of these resistances. A non-radiating dummy antenna made up of very low loss inductances and condensers might approach zero total resistance and zero effective radiation resistance. On the other hand, an antenna worked at a frequency nearly double its fundamental will approach an infinite effective total resistance and an infinite effective radiation resistance. In general, however, when an antenna is worked well above the fundamental frequency, we may expect extremely high resistance, even as high as 100 ohms, and possibly more. We shall probably not wish to work with a resistance higher than 100 ohms, because that will involve a very small antenna series tuning condenser over which there will be a very great drop in potential leading to abnormal condenser losses and the necessity for extra high insulation. There will be a happy medium which for very high frequencies will probably be, judging from our experience to date, in the neighborhood of 50 ohms.

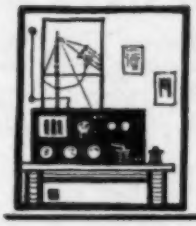
By using good porcelain insulation on antenna and counterpoise and having the counterpoise at least several feet above the ground and clear of obstacles, or several feet above the roof, the ohmic and dielectric losses may be reduced to an almost negligible point compared with the effective resistance of the antenna. This means that the antenna will radiate probably 90% of the energy which is put into it. This being the case, it will make little difference what the actual height of the antenna is. Practically all of the input energy will be radiated whether the antenna is high or low. Of course, one can not go to great extremes, but it is safe to say that there is little choice at frequencies between 3,000 and 6,000 kilocycles between an antenna 15 feet high and one 45 feet high. True, the low one will absorb much more antenna current, but the effective resistance which is nearly all radiation resistance, will be correspondingly lowered so that no more and no less energy will be radiated.

When operating at high frequencies it is therefore obvious that the antenna current itself is in no sense a proper measure of the probable range of the set, which is more properly related to the antenna watts. This is of course true of all frequencies, but for lower frequencies there is a relatively small error in basing range calculations on antenna current. One might say that the antenna current at high frequencies means nothing at all; it is merely a convenient way of telling when the antenna is in resonance. If the effective resistance and the effective radiation resistance have been measured by standard methods, then the total antenna watts and the total radiated watts may be calculated. Inasmuch as this is rather difficult to do, at high frequencies, the following method may be substituted. Place the transmitter on a dummy antenna with adjustable capacity, free resistance and adjustable inductance, until the set gives the same performance and meter readings as it does on the actual antenna. The energy in the dummy antenna may then be calculated from the square of the current multiplied by the resistance. The resistance should be made as compact as possible without introducing a serious amount of distributed capacity. This is going to introduce difficulty of course, in very high power sets, but works out very well up to 1 kilowatt in the antenna. From these figures can be computed the efficiency of the set which under normal conditions will probably fall in the neighborhood of 50%. The same data will give the effective total resistance of the antenna. The various losses from dielectrics may be separated in the usual manner but it is hardly worth while if any care at all has been taken in the construction of the antenna, because at high frequencies the resistance is nearly all radiation resistance.

Considerable argument has developed, especially among amateurs, as to the advantages and disadvantages of operating an antenna a long way above its fundamental frequency. There can be no doubt but that operation at 1500 kiocycles would be effective when operated a long way above the fundamental[1], because the chances of making the radiation resistance a large percentage of the whole resistance are very much better, but between 3,000 and 6,000 kilocycles the situation is altogether differ-

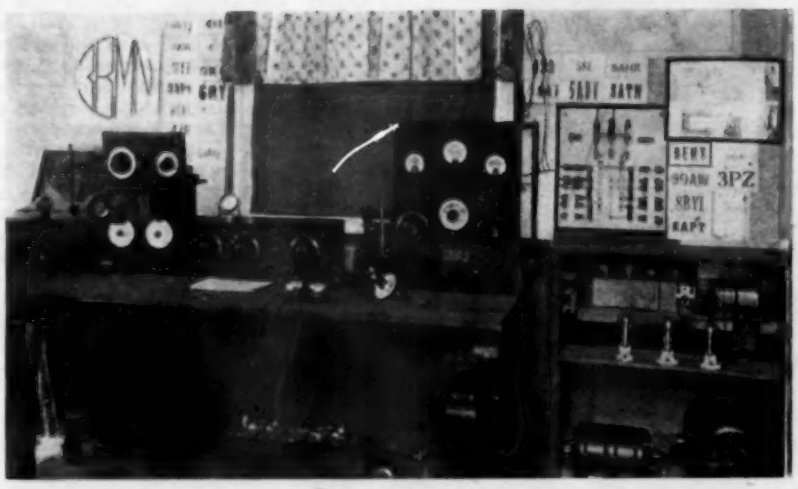
(Concluded on page 63)

[1]I.e., a long way below the fundamental wavelength. —Tech. Ed.



Amateur Radio Stations

3BMN, Petersburg, Va.



The needle on the antenna at 3BMN first wiggled on a memorable day in July, 1922. Just one year of successful hookups and patient juggling of apparatus preceded this event. The present station is the result of a good deal more experimenting and 3BMN now ranks as one of the foremost high power 5-watt stations in the country.

The apparatus is installed in a ten by ten foot shack on a level tract of land at 617 Union Ave., Petersburg, Virginia. The masts at the station are two, a 41-foot wooden mast near the shack, and a 50-foot iron pipe mast at the end of an inverted L antenna. The present antenna is a six wire cage, 81 feet long, and with three and one half foot brass hoops as spreaders. The wires are No. 12 solid copper, enameled. The counterpoise consists of four similar wires on a 12-foot brass spreader 100 feet long. They are supported 18 feet in the air; this height being necessary to clear several small peach trees which were unknowingly planted so as to interfere with the progress of science. There is an addition to this counterpoise to one side of it at the same height as the main counterpoise. This addition consists of four copper strips arranged in fan fashion, each strip being 75 feet long. Both the antenna and counterpoise leads are brought into the station through heavy glass tube insulators.

Entering the shack, you will see a station somewhat different from the average. As can be seen in the photograph, all of the transmitter plate supply apparatus, consisting of motor generator, chemical rectifier, "S" tubes, transformers and filters, are neatly installed in a cabinet to the right. Various plate supplies are available by throwing the proper switches. In the center of the picture is the transmitter panel, behind which is mounted the 5-watt tube and associated apparatus. This is the stand-by set at 3BMN, other sets are used only occasionally. The 5-watt tube at present thrives on 600 volts and 75 milliamperes in the plate circuit. The antenna current is 2.5 amperes. This makes a plate input of 45 watts and an output in the neighborhood of 30 watts. The reversed feedback circuit with series supply is employed. The normal wavelength is 165 meters but by carrying the General Radio .001 μfd condenser in the antenna circuit, other wavelengths

can be adjusted for at will. The transmitting apparatus is home-built in so far as practicable. The transmitter panel and mountings, plate and filament heating transformers, inductance and grid coil, radio

"Ray", Waiting for the Postman

frequency choke coil, 10,000 turn iron core choke and the rheostat are all home-made.

The receiving apparatus consists of a 1BGF tuner built from the description in February, 1924, *QST*, a Grebe CR13, and a long wave honeycomb coil set. Several European stations have been heard in addition to hordes of American amateurs. The long wave set is very convenient and affords the necessary romance in getting off the beaten path of short wave stuff once in a while.

On the table at the extreme left of the photo is a portable transmitter using one VT-2 operated under the call 3CCJ. Some interesting experiments have been carried on during the summer just past with this set.

The signals of 3BMN have been reported heard in 40 states, four Canadian districts, Hawaii, Panama, Cuba, Porto Rico and England. Stations in 34 states have been worked using the lone 5-watter in the sending set. The best distance worked in daylight was 1000 miles. 3BMN manages to maintain a consistent working range of nearly 1200 miles. During the past two years there has only been four months of inactivity at 3BMN with the exception of a few tube-less and antenna-less days.

3BMN is an important traffic station having schedules with stations to the North and South for quick and prompt handling of messages. The average number of messages handled per month has been 100, though 1336 were handled in one month during the race with 3ZO for first place in the brasspounder's league, some time ago.

"Ray" Carr, the true amateur behind all of the noise at 3BMN, is an A.R.R.L. man and is ever on the job. He and his station hold the appointments of: Official Relay Station, Official Broadcasting Station, Dist. Supt. of No. 2 Virginia District and Roanoke Division Publicity Manager.

2BRB, Brooklyn, N. Y.

—Photo Courtesy Foto Topics, Inc.

Here is shown Edward M. Glaser, newly elected manager of the Hudson Division, on the job at his station, 2BRB. This station is one of the most active in the Second District and has several good DX records to its credit. Starting with a spark coil back in April, 1921, 2BRB has passed through all of the stages of evolution of an

amateur station until at present Mr. Glaser's station sports a 250-watt tube and also a 50-watter.

The transmitter uses the straight Hartley circuit with parallel feed. The receiver is a Reinartz set that has proven very satisfactory. The antenna is a six wire cage of the inverted L type, about 55 feet high and 55 feet long. The counterpoise is a seven wire fan directly under the antenna and ten feet above the ground. Porcelain insulation is used throughout the radiating system.

2BRB has been heard in New Zealand, Argentina, Peru, several European countries, Alaska, Canal Zone, WNP, Azores, and Mexico. West coast amateurs are worked regularly during the winter months. The station is an Official Relay Station and an Official Broadcasting Station. 2BRB is QRV for traffic and would appreciate reports on Official Broacasts.

9VK, Oak Park, Ill.

9VK is owned and operated by F. H. Lester, 1155 Wisconsin Ave., Oak Park, Ill. The station is devoted almost exclusively to experimental work. Much of the apparatus is home-made.

The transmitting set uses four 50-watters, built up behind a panel. Part of the rear of this panel can be seen on the right in the photo. Chemically rectified and filtered "juice" is supplied the plates. Suitable switching arrangements are provided on the set for using C.W., I.C.W. or phone.

The receiving sets are; a 95 to 200 meter receiver, a three circuit variometer set, a honeycomb coil set, and a two stage audio amplifier that can be used on any of the sets. Western Electric and Brandes fones, and a Magnavox loud speaker complete the receiving equipment.

The antenna is a four wire flat top, T type, 70 feet long. The counterpoise is 60 feet long by 30 feet wide and ten feet high, fanned. The complete antenna system is insulated with long porcelain insulators.

During the short time the set has been in operation, the signals of 9VK have been reported heard in every district in the U.S., Hawaii, Canada, by WNP, and other ships at sea.

F. H. Lester, the builder and operator is an A.R.R.L. member and Oak Park correspondent for the news department of the League. A word from those who have heard 9VK will be appreciated.

MAKING THE FIVE-WATT SET WORK

By H. F. Mason, Dept. Editor

LAST month's Amateur Builder article told how to build a simple sending set, using one five-watt tube for $25. The present article is a continuation of the previous one and tells how to build a transformer, rectifier and filter for power supply, and how to adjust the set for best results.

Plate Supply

There are many ways of providing a source of high voltage supply for the plate circuit of the transmitting set. Each method has its advantages and disadvantages so no one way can be considered best. The methods may be broadly divided into two classes those where the plate current is a pulsating direct current, and those where the plate current is a steady direct current.

You should decide whether you want pure direct current or pulsating direct current in the plate circuit. Pure D.C. is superior from most standpoints, but the initial cost is more. Probably the most convenient way is to begin by using "A.C. on the plate" and put in a rectifier and filter later, but if your pocketbook will stand it, put in D.C. at the outset.

The simplest and usual way of obtaining a high voltage supply that is not pure D.C. from the commercial power mains is to use a step-up transformer and connect its

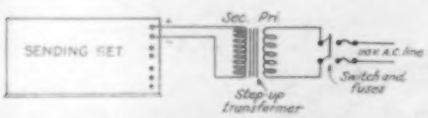


FIG. 1 CONNECTIONS FOR "A.C. ON THE PLATE."

secondary directly to the high voltage terminals on the sending set as shown in Fig. 1. The vacuum tube in the set will automatically use only one half of the alternating current cycle, so the plate current will be of a pulsating-direct nature. By suitably arranging the windings of the transformer when building it, you will only have to add a rectifier and filter to change the plate supply to pure D.C. later.

Filament Supply

The filament circuit will require 2.35 amperes at 7.5 volts. This may be supplied from an eight volt storage battery, or it may be alternating current furnished from the commercial power lines through a small step-down transformer. Transmitting tubes last longer when supplied with A.C. so A.C. is preferable. A separate transformer is not required for filament heating if you already are planning on a transformer for plate supply. A few turns of wire can be put around the core of the plate transformer as a secondary winding for supplying the filament circuit and the necessity for a separate filament transformer will be done away with. Combining the plate and filament transformer as one unit in this way simplifies the set and effects quite a saving in the cost of the equipment.

The Transformer

Complete details for the construction of small transformers were given in the Amateur Builder articles in the May and June, 1924, issues of *QST*. Unless you are familiar with making small transformers, by all means read these articles before building the transformer and filter choke coil for your five-watt set. Because the constructional details are covered in the previous articles, only the essential dimensions of the transformer will be given here.

The core for the transformer should be 1⅜ by 1⅜ inches in cross section with a window measuring 1¼ by 3 inches. The two sizes of laminations needed to construct this core should measure 1⅜ by 4⅜ inches, and 1⅜ by 2⅝ inches. A stack of each size of laminations 2¾ inches high will be required.

The 110-volt primary winding should consist of 437 turns of No. 21 D.C.C. wire. The total length of the winding should be 2⅞ inches. The wire should be layer wound with a layer of heavy paper between each two layers of wire. When finished, put on several more layers of heavy paper and wind the filament winding over the primary. The filament heating winding consists of 32 turns of No. 16 D.C.C. wire

wound in a single layer with a tap brought off at the exact center of the winding.

The plate circuit supply winding is wound on a fibre form which is slipped on the other long leg of the core. This winding consists of 6630 turns of No. 30 enameled wire wound in smooth layers with a layer of writing paper soaked in paraffin interposed between each two layers of wire. Taps should be brought off at the 1463rd, 3315th, 5177th and at the end or 6630th turn. This gives a winding with a center tap and the choice of about 450 or 800 volts on each side of the center.

So far we have provided no way for adjusting the filament voltage to its correct value. This is best done by means of a rheostat connected in series with the primary of the transformer. The type E-210 Bradleystat* is admirably adapted to this purpose. This is not the regular receiving Bradleystat, by the way, but is somewhat similar to it. It is not advisable, when using pure D.C. plate supply, to connect a rheostat directly in series with the filament supply winding, for it unbalances the center tap and is likely to cause an A.C. hum in the output.

How to Make the Rectifier

The electrolytic rectifier is inexpensive and is certainly very popular among amateurs. If properly built and taken care of its performance will be entirely satisfactory.

The following materials are required:

48 Jelly tumblers (about 3 inches tall).

48 pieces good pure aluminum. 1 by 3½ inches.

48 pieces sheet lead. 1 by 3½ inches.

48 8-32 Round headed Brass Machine screws, ⅜ inches long, with nuts.

1 pkg. 20 Mule Team borax.

1 bottle household ammonia.

1 box for rectifier.

1 can lye.

The construction of the rectifier box is evident from the drawing, Fig. 3. The exact dimensions will depend on the size of the rectifier jars, but in any case the box should be built so the jars may be installed in four rows of twelve jars each, with a partition between the rows. The box should be given a couple of coats of shellac inside and out. Before assembling the rectifier a layer of fine sand or sawdust should be placed in the bottom to absorb any liquid that might be spilled in the process of filling and refilling the jars.

A hole should now be drilled near the end of each of the 96 elements. Before bolting them together, however, both the aluminum and lead pieces should be dipped in a hot lye solution to remove all dirt and grease. It is very important for the proper functioning of the rectifier that the elements be absolutely clean to begin with.

The lye solution should be mixed in an old enamel pan and the whole cleaning operation should preferably be done in the open. The reason for not doing it in the house is because the fumes from the solution will turn black all of the metal work in the vicinity. You may also see black if you inhale the fumes, so be careful.

The solution consists of a half a dozen tablespoonful of the lye dissolved in a

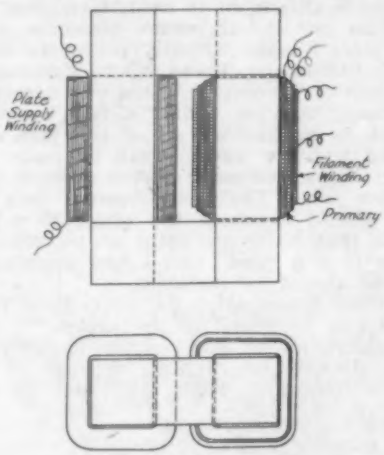


FIG. 2 THE TRANSFORMER

pan holding about a gallon of boiling water and stirred with a stick. Dip each piece of aluminum into the solution, holding it by a wire hooked through the hole, and let it remain submerged until the aluminum froths violently. It should only take a few seconds at most. Now remove and wash thoroughly in running water. Do not let any of the lye solution touch your fingers, and do not touch the elements with your hands after they are washed. The aluminum should now present a clean, silver-like surface. Any black spots or streaks denote impurities in the aluminum and show that the aluminum is not good enough for use in a rectifier. However, if the aluminum is obtained from a reliable source, and is recommended for rectifier use, no trouble should be had in this connection.

When the aluminum strips are finished, do the same with the lead strips. A new solution may be necessary, if the old one does not seem to have much strength left.

Forty-six pairs of elements (a pair consisting of one piece of lead and one of aluminum) are now bolted together tightly, and bent to fit the jars. The remaining four pieces are used for the terminal elements.

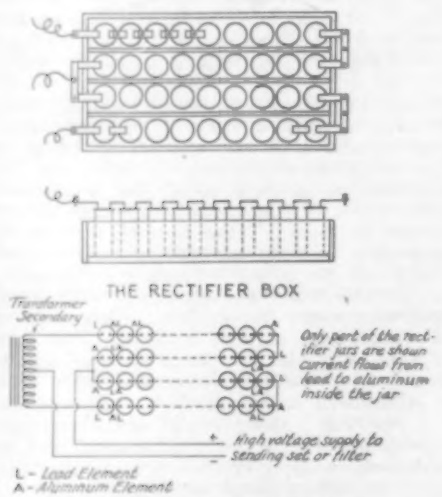
The rectifier solution should be mixed in a large clean bucket or crock, mixing enough at one time to fill all of the rectifier jars

*Further information regarding this instrument may be obtained from the makers, the Allen-Bradley Co., Milwaukee, Wis.

if possible. Into the container full of boiling water, slowly dump the borax, stirring all the while. Continue until the solution becomes saturated, i.e., until the water will absorb no more borax. Now let the solution stand for 24 hours to give any excess borax a chance to settle. Then, without disturbing it any more than necessary, fill the rectifier jars from the top part of the solution. When the jars are filled and the elements in place, put a half teaspoonful of household ammonia in each rectifier jar.

If pure aluminum is used, formation of the film on the aluminum elements will take place almost instantly, when the current is turned on. There will be a momentary rush of current, but this will decrease to almost nothing within a few seconds. A test as to whether all of the jars are formed and are working can be made by connecting a voltmeter across each of the rectifier jars. The voltage across each of them should be about the same, 40 volts. A jar that has very little or no voltage across it is a "dud" and a new aluminum element should be installed.

Further information on electrolytic rectifiers can be found in the article "Some Characteristics of Electrolytic Rectifiers," by E. J. Atkinson, 1CEK, on page 66 of of the February, 1924, *QST* and in "A Symposium on Aluminum Electrolytic Rectifier Operation" on page 20 of the June, 1922, *QST*.


THE RECTIFIER BOX
Transformer Secondary
Only part of the rectifier jars are shown current flows from lead to aluminum inside the jar
High voltage supply to sending set or filter
L - Lead Element
A - Aluminum Element

HOW TO CONNECT THE RECTIFIER JARS

FIG 3

The Filter

A type of filter that is simple to install, yet one that gives general satisfaction, is the "brute force" type, described on page 24 of the August, 1923, *QST*. The connections are shown in Fig. 4. Undoubtedly, the secret of success of such a filter is the choke coil, which must be large and husky. The two-microfarad condensers at each end of the choke coil are paper condensers capable of withstanding 1,000 volts. It is better to buy these than to attempt to make them yourself.

The essential dimensions of a 30-henry choke coil for your filter are given in Fig. 5. The core should measure 2 by 2 inches in cross section. Two sizes of laminations are required; a stack four inches high of pieces 2 by 5¼ inches, and a stack four inches high of pieces 2 by ¾ inches. There are two airgaps, each 7/64 of an inch wide, making a total airgap of 7/32 inch. These airgaps should be filled with cardboard. Some arrangement must be provided for tightly clamping the core together. The winding consists of 4110 turns of No. 30 enamelled wire, layer wound with paper between the layers. The coil should be taped before putting it on the core. Details of assembly are given in the previously referred to article on transformers.

Other Plate Supply

Of the many ways of obtaining pure D.C. at high voltages for supplying the plate circuit, the rectifier-filter combination described above is the simplest and least expensive. Though simplicity and cost are usually the first considerations, some other feature may cause a different plate supply method to appeal to you more. For instance, "S" tubes, which take up little room and are quiet, will probably appeal to the amateur who has his set in the parlor and whose wife will not stand for having a half a hundred rectifier jars sitting around for the baby to get mixed up in. A motor generator set makes a nice source of high voltage, mainly because it has few of the ailments common to most types of rectifiers. Storage B batteries are fine for plate supply and no filter is needed with them. However, like an electrolytic rectifier, they need a certain amount of nursing to keep them in operating condition. Kenotron rectification is not used much in amateur stations, mainly because the amateur would rather invest his money in more oscillator tubes than to purchase rectifier tubes. This method of rectification is used extensively in commercial tube transmitters, however, so it must be proving dependable.

Generally speaking, a different filter will not be required for different plate supply methods, provided that a good "brute force" filter is installed to begin with. Nevertheless, it is always well to make tests occasionally and try different combinations and values of choke coils and condensers in your filter until the ripple or hum is completely eliminated.

Connecting the Set to the Line

The high-voltage wiring and the 110-

volt wiring around your sending set should be neatly installed. Lamp cord strung in spiderweb fashion all over your station not only looks bad but makes it very easy, sometimes, for a fire to get started. The article "Getting on the Air" in the Junior Operator section of the January, 1924, *QST* tells the proper way to hook up the set to the 110-volt wiring. A separate line from your house meter and a switch, and fuses installed at the set, will be all that is required in most cities.

Tuning the Set

When the set has been entirely installed, you are ready to begin tuning it. A tube transmitter should be very carefully tuned to a certain wavelength, and then left that way. If you change the wavelength of the set every time you transmit, as some misguided amateurs insist on doing, then you are sure of two things; first no one will know on what wave to listen for you on, and, second, that you will not have the set working at its best on any wave. Moral—adjust your sending set to do its best, then leave the adjustments alone.

A wavemeter having a flashlight lamp or a neon tube as an indicating device will be required. The first adjustment is to remove the antenna and counterpoise clips from the fixed coil on the set and tune the closed circuit to the desired wavelength. This closed circuit consists mainly of the hinged coil as the inductance, and the fixed glass plate condenser as the capacity. Place the grid and plate clips on about the first and twentieth turn and the filament clip about midway between. Upon pressing the key, the plate current meter should indicate current. However the circuit may or may not be oscillating. To find out for sure, hold the wavemeter so its coil will be a few inches from the hinged coil and about in the same plane, and slowly turn the dial on the meter. If the set is oscillating the flashlight lamp will light when resonance is obtained between the two circuits. Should the lamp fail to light, turn off the power, move the filament clip a turn or two one way or the other, and try again. The wavelength of the closed circuit corresponds to the wavemeter setting at which the lamp lights. It is the number of turns between the plate and grid clips that determines the wavelength of the closed circuit and by changing the number of turns the wavelength can be varied until it is just about what you want. If you have trouble in adjusting this circuit exactly to the desired wavelength, shift all three of the clips a few turns along the inductance where the turns are a different diameter and try again. Keep the filament clip somewhere between the other two clips, varying it one way or another until the set oscillates steadily and does not quit when the wavemeter is brought near.

A little practice in using the wavemeter will be helpful. The meter should not be held too close to the hinged coil or the flashlight lamp may burn out when resonance is approached. The most satisfactory wavmeter readings are obtained when the meter is held far enough from the set so the lamp will just barely glow when in exact resonance.

After adjusting the closed circuit to oscillate steadily on the desired wavelength, place the antenna and counterpoise clips on the fixed coil with about twenty turns between them and, with the key down, start varying the antenna series condenser slowly, watching the plate milliammeter and the antenna ammeter. As the point of resonance is approached the antenna current meter will slowly climb, and the plate current meter will change. The condenser handle must be moved very slowly, as the resonance point is quite sharp. If the resonance point cannot be found with twenty turns in the antenna circuit ,try other values because much depends on the antenna system you are using.

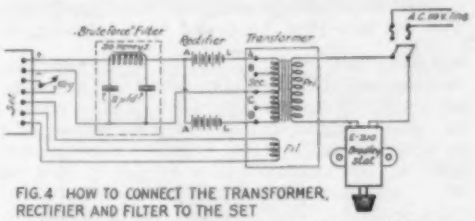


FIG. 4 HOW TO CONNECT THE TRANSFORMER, RECTIFIER AND FILTER TO THE SET

(If "A.C. on the plate" is used, connect terminals A and C direct to the set as shown in Fig. 1.)

Do a little exploring at this stage of the game and learn all you can about the set. Loosen the coupling until the set stops oscillating and the antenna circuit will not "pick up" the energy from the closed circuit any more. Now you know how far you can go. Next tighten the coupling until the set acts unstable, perhaps stops oscillating, and the antenna current drops. If you have your wavemeter handy, measure the wavelength at different values of coupling and you will find that the wave rises when the coupling coils are placed close together and drops when they are separated. The best coupling adjustment is to have the coupling as loose as practicable without the antenna current dropping. If the coupling is too tight you will not be able to run the antenna circuit into exact resonance with the closed circuit without having the circuit oscillate unsteadily or stop entirely. Don't be surprised if the best adjustment is with the coils several inches apart; this is not uncommon.

Now try varying the grid leak. Lowering the resistance will cause an increase in plate current and vice versa. However,

one adjustment will give the greatest antenna current for the least plate current, and that is what we are aiming for in adjusting the set to work its best.

Getting down to the 75 to 80-meter Band

The only change required to make the set operable on a wavelength within the 75-80 meter band is to remove one of the tinfoil sheets from the closed circuit fixed condenser, leaving two sheets only, one being connected to each terminal of the condenser. The set can then be tuned to a wavelength

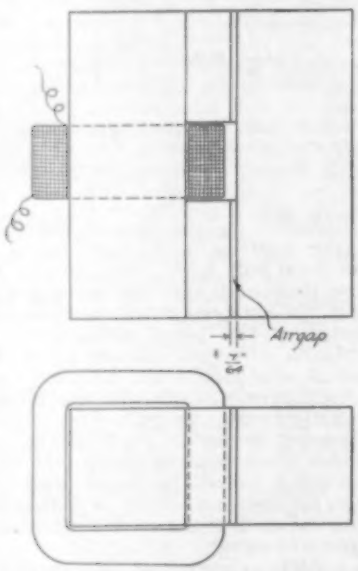


FIG. 5 30 HENRY CHOKE COIL

within the above band without much difficulty. The antenna system used should not have a fundamental wavelength of over about 80 meters, however, for best results, unless you work the antenna on a harmonic as explained in the August, 1924, issue of *QST* on page 12.

What to Do Next

With the set completed and "On the Air" you should have no trouble getting in touch with amateurs in other towns and getting acquainted with them via radio. The article "Getting on the Air" on page 55 of the January, 1924, *QST* will also be of value. In conclusion you will find that, if approached in the right way, many of the old timers will go out of their way to give you useful hints and information regarding the operation of your set and advice that will help you greatly in getting the maximum amount of benefit and enjoyment from your radio station.

THE V. T. VOLTMETER

(Concluded from page 45)

readings may be under actual load conditions as in Fig. 4.

Caution: Always start with the grid very highly biased, to keep excessive plate currents from flowing. However, be sure that you do not make the final readings with more than *just enough* bias to stop the plate current, otherwise the readings will be too high.

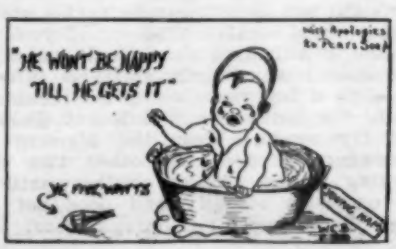
A Rough Method of Finding "Mu"

If no voltmeter is available, approximate results may still be obtained. Use A.C. in the plate circuit (SEE WARNING BELOW) with phones in series. The voltage of the lighting circuit can be obtained from the power company and this will answer for very hurried work. The voltage ordinarily given for commercial A.C. is the effective voltage, which is 1/1.4 of the peak voltage which we are measuring. Connect as shown in Fig. 4 and bias the grid until the plate current just disappears; in other words, until the sound in the phones just stops. The plate peak-voltage is 1.4 times the effective a.c. voltage and the amplification constant is

$$\mu = \frac{1.4 \text{ (line voltage)}}{\text{Bias voltage to stop plate current.}}$$

(This method is not accurate, as the line voltage is seldom known exactly unless it is measured. It might be almost as well to rely on the tube-maker's catalogue for the value of μ. However, either of these methods is better than guessing at the voltage on the tubes as most amateurs do —I have known them to miss it 500 volts out of 1000!—Tech. Ed.)

WARNING: When using high voltages on the plate it is not safe to put phones directly into the plate circuit as has been suggested. Instead make the connections as shown in Fig. 5a, using a small transformer that is *very* well insulated. A suitable one is shown in Fig. 6. Don't use "any old thing" and risk death.



INTERNATIONAL Amateur Radio

6CGW Nearly Wins It

Two way amateur communication with New Zealand came a good deal nearer a few nights ago when 6CGW nearly "clicked" with New Zealand 4AA. "6CGW sure gave me a thrill last Sunday night," says N. Z. 4AA. "He had just been calling N. Z. and Australian stations and signed off with '—REPLY NOW ON 120 METERS.' I answered him and gave him a 'K'. Immediately 6CGW came right back with, '4?? N. Z. U 6CGW—TRY AGAIN OM.' I duly gave him another call, but he evidently got nothing."

So old 6CGW may win the boomerang yet. But until he actually gets it, everyone else will have a chance at it. You have probably heard already of the genuine Australian boomerang, suitably engraved, that is to be given by the A.R.R.L. to the American or Canadian amateur who is first to definitely establish two-way communication between New Zealand or Australia, and North America. If not, then reread the "dope" on page 43 of the April, 1924, *QST*, raise your plate voltage, put in a good receiver, and try for the antipodes!

DX records in the making, Ralph Slade, 4AG, listening to U.S. amateurs from his station in Dunedin, New Zealand.

When to Listen for N. Z. Stations

"Several Yanks have inquired as to the best time for them to listen for N. Z. stations. I believe the best time would be from 7 to 8 P. M. on Sunday evening, N. Z. time. This hour corresponds to that from 11:30 P.M. to 12:30 A.M. P.S.T. on Saturday night and Sunday morning with you," says Mr. Bell, N. Z. 4AA, in a recent letter to *QST*. "Our usual traffic waves are from 130 to 190 meters but I will try and get the fellows to QSY to around 100 meters, and get as many of them to join in on a weekly "CQ party" as possible at the above time. Please pass the word to the gang on your side about it. It won't be an official test, but just a friendly attempt to get in touch with one another. At 8:00 P.M. we will listen for any replies from the States (or elsewhere Hi!). This would also be a good time for any station that wished to broadcast traffic for New Zealand or Australia to do so."

Another Trophy!

Major Raven-Hart, the first real "ham" in Chile, offers a good Chilean hat—and they are wonderful affairs, he says—to the A.R.R.L. to be awarded to the first U.S. or Canadian amateur to work two-way with Chile. Just to make it all the more worth while wining he is having it nicely decorated with native silver!

The Chileans are fast getting their stations into operation and with the above incentive for us it should be only a short time before someone wins the hat!

"Do it this winter or bust!" is Major Hart's motto. Let that be our motto, too, fellows!

The present address of Major R. Raven-Hart is, Union Club, Necochea y Peru, Mendoza, Argentina.

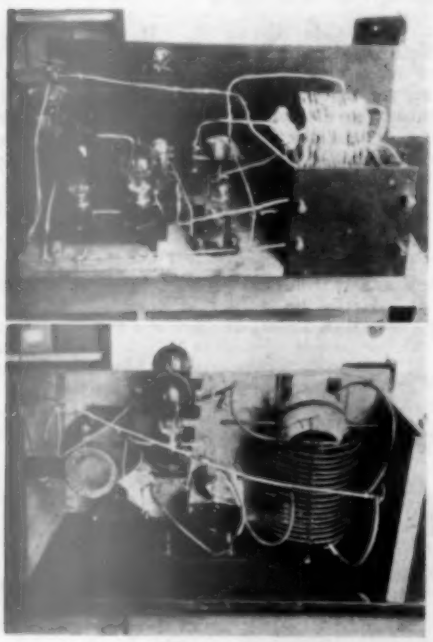
New Zealand 4AG

Ralph Slade, 4AG, was the first New Zealand amateur to do any "Yank logging", as the receiving of American amateurs in New Zealand is called. It was on November 5th, 1922, that he heard his first signal from a U.S. amateur. Ever since that time he has stuck to the game and he now has as good a DX list to his credit as anyone in New Zealand.

The photograph shows him busy at his favorite pastime, varying the ratio of inductance to capacity in his new set. Note

the grin—the probable reason being that he has just heard another U.S. station. The receiving set he uses will be recognized as bearing a resemblance to the tuner described by Perry Briggs, 1BGF, in the February, 1924, *QST*.

On the wall to the right of the picture are cards from every district in the U.S. Quite an imposing spectacle; for Dunedin, N.Z., at least. Mr. Slade hopes to have the entire room papered with these cards soon. More power to him.



The receiver (above) and transmitter (below) at 4AG. Not much to look at, but they sure do the work.

The transmitter and the receiver at New Zealand 4AG are shown in the other photographs. The transmitter is just mounted on part of a wooden box, but it works, and works well. Nightly communication is carried on across 1,400 miles of water to amateurs in Australia. A unique feature of the sending set is the inductance, which is made by lashing the turns of copper tubing to pieces of glass rod or tubing as supports.

European Conditions Promising

During the last few months, owing to heavy static, two way work between amateur stations in America and Europe has practically ceased but with fall approaching we have many new stations on the air. The shorter waves are of course the more popular and the 100-130 meter band is filled with strange calls from many countries.

Sweden has five licensed stations in action and at least two of these are in touch with Britain on very low powers. The calls of Swedish hams are prefixed with the letters SMZ. The five active stations are SMZP, SMZS, SMZV, SMZY and SMZZ. Of these, SMZP has worked g2KF and SMZZ has exchanged signals with g2XG, the former using 10 and the latter 20 watts.

In Finland there are four stations now working with short wave permits and they usually prefix their calls with FN. They sign 2NB, 2NM, 2NC, and 3NB.

Italy has three active stations at the time of writing, ACD, 1ER (possibly IER1 Dept. Ed.) and 1MT. The former has worked with the U.S.A.

France has now many short wave stations and a good bunch of them should get across this fall Their calls all begin with the numeral 8.

Spain has been late in getting into action but at least one station near Madrid is making preparations for working during the winter on short waves.

The Swiss amateurs have not been much in evidence of late but we expect to hear XY of Geneva in operation again soon, when conditions are more favorable.

Holland is quiet except for a few weak "zero" stations. PCII and PA9 are still closed down.

In England we are looking forward to a very interesting and busy DX season this year. g2NM, g2OD, g2SH, g5BV, g5LF and many others are getting ready for a "can busting" season. In the north we have g2KW and 2PC, who have been joined by 5KO and 5MO. g2DX is located at Camberley, Surrey. g2KF will commence the season on 112 meters and will use that wave as a stand-by throughout the winter tests, but the power will remain at 100 watts as at present. This station will welcome tests on waves down to 50 meters.

—J. A. Partridge, g2KF.

Federico Mejia, 14a Avenida Norte, 21, San Salvador, Republic of Salvador, is on the air with two 50-watt tubes trying to connect with amateurs in the U.S. and foreign countries. He would appreciate a line from those interested in forming a relay route, to South America especially. His call is FMH but his wavelength is unknown, sorry to say.

Strays

During vacation season many amateurs are having the time of their lives traveling away from home and visiting every amateur station they can find. But there are many antennas these days; can you recognize those of your fellow amateurs? You can if he has his call or an A.R.R.L. emblem displayed in some prominent place around his station; on the door of his shack or on his mast. Is your station properly advertised in this manner?

The recent broadcasting of the Democratic National Convention had an alarming effect on the Washington Radio Club. Last Saturday evening when Mr. Bidwell got up to say something the chair demanded, "For what purpose does the gentleman arise?" This new and unhappy greeting was just as confusing to Mr. Bidwell as it was to the rest of the convention delegates. However, Mr. Bidwell proved to be very resourceful and just as he was going to be called out on the count of ten he thought of something to say and announced that he would discuss the subject of the Key Klick Klunkers. The matter was warmly debated, and a motion was finally made and seconded that the offending stations which caused unusual key klick interference with neighboring broadcast receivers be disapproved of. This was promptly amended to read that the offenders should be called out by name, which amendment was carried by a margin of one-fourth vote. Attention was then called to the fact that Mr. Bidwell was by far the biggest person present, and was therefore unquestionably the delegate at large, and consequently entitled to but one-half vote. This ruling of the chair defeated the amendment and the original motion was then carried with the aid of a visitor from Alabama, 5QRT, who successfully claimed 24 votes. It was later reported that while at the beginning of the meeting the delegates were about equally divided between the two parties, at the end they were solid for the Republican ticket.

—C.A.B.

What is a Gazilterswitch? Aha! Therein lies a secret of the deepest kind. One day amateur 5AM made the discovery that by shunting his filter circuit with a switch he was able to raise many amateurs with sharply tuned receivers that he could not get to answer him on the pure D.C.

He also was able to raise the wrath of the neighboring B.C.L.s and the other hams in the town.

Finally it was decided in meeting to present this amateur with a specially designed switch for the above purpose at the regular semi-monthly meeting of the radio club at New Orleans.

This was done with all due ceremony, and though 5AM promised to use the switch faithfully, he has seldom been heard without the filter since that time. Evidently the idea worked!

On June third the seventh district Supervisor of Radio went to Boise, Idaho, to hold license examinations, and to the surprise of the "regulars" a girl of sweet sixteen entered and took the examination.

Miss Harriet Ellsworth is now 7SI. Con-

gratulations, Harriet, F.B.! She is the second young lady amateur in the seventh district now, and is just as enthusiastic about amateur radio as any "ham" could be. Idaho amateurs are now all shining up their sets preparatory to arranging schedules with 7SI for Boise traffic!

If you happen to hear some strange

Eighth District Stations one of these nights, the chances are that they may be in Newfoundland, and are Canadian 8's. Newfoundland time is one hour and a half ahead of Eastern Standard Time. The Canadian part of the Maritime Division is one hour ahead of Eastern Standard Time.

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1XAQ-1OA-1AEL-1ASN-1ID are NM. This combined station at Silver Lane, Conn., owned by Messrs. Kruse, Beekley, Budlong,

and Mason of *QST* staff burned down on Friday, August 22nd, as can be seen in the photo. Much radio apparatus went up in smoke. No, the fire did not start in the radio room.

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In order to stimulate interest in amateur radio, Mr. H. L. Reid, manager of the Southeastern Division of the Traffic Department of the League, is offering a loving cup to the amateur in the Southeastern Division having the best all around amateur station. The contest will be handled similar to the National Hoover Cup contest. The contest for the Southeastern Division Cup closes December 31, 1924. Amateurs in that Division desiring to enter their station should mail their reports and descriptions to Major W. Van Nostrand, Federal Buliding, Atlanta, Ga. They will all be taken care of and returned in good shape. The committee of judges will consist of Major W. Van Nostrand, U.S. Supervisor of Radio, H. L. Wills, Georgia Railway and Power Co., and Mr. H. E. Bussey, General Electric Co., all of Atlanta.

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The David Grimes, Inc., with executive offices at 1571 Broadway, Strand Theater Building, New York City, New York, has recently been organized by David Grimes, the inventor of the Grimes inverse duplex system (now called the super reflex). The object of the new organization is to produce a radio set employing the Grimes System at a popular price and embodying all modern features. The General Sales Manager is Mr. E. P. H. Allen, formerly with the Radio Corporation of America, and for many years a prominent figure in the music trades. The company will also manufacture a general line of radio instruments and parts. The plant and laboratories are located at 141 Morgan Street, Jersey City, New Jersey, where they occupy a modern 8 story building equipped with the latest labor saving devices.

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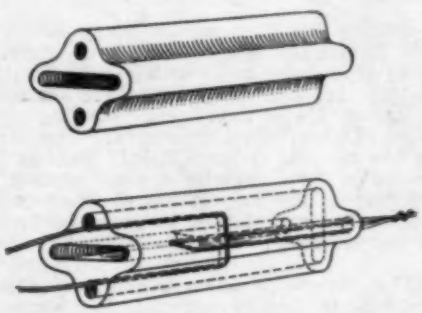
A Better Guy Insulator

The cut shows very clearly the construction of the white glazed porcelain guy insulator known as the Kreuz. The insula-

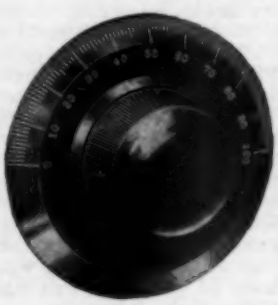


tor is 4½ inches long and the holes are one quarter inch in diameter.

The insulator may be obtained from H. O. Boehme at 241 Lafayette Street, New York City.

—·—·—

The National Velvet Vernier Dial, manufactured by the National Co., Inc., 110 Brooklin St., Cambridge, Mass., who are also makers of the National variable condenser, is a vernier dial to be proud of. It employs no gears or rubber tired wheels but depends upon metal planetary friction discs, held together by springs, for its



action. There is no back-lash. The dial is very attractive looking and is made in both three and four inch diameters to fit devices having 1/4 inch shafts. The only possible objection is that the National dial is more difficult to mount than an ordinary one, but this disadvantage is more than offset by the good points of this truly "velvet vernier" device.

Radio Communications by the Amateurs

The Publishers of QST assume no responsibility for statements made herein by correspondents

Receiving in the Dark

Cleveland, Ohio

Editor, *QST:*

Can one receive better, or faster, in darkness than in the light, you ask in this month's *QST?* The answer is yes, by all means. I don't pose as a phychologist, but I have always believed the reason was that with the eyes open and the room well lighted the eye always roamed about the room, watching for anything which might take place. If the room is in darkness and the brain isn't receiving any impressions from the eye it is more alert to the things brought to it by the ear. To put it electrically when the eyes are turned off the load is lighter so there is more juice to operate the receiving apparatus connected with the ear.

Another thing, most of us can receive faster sending and copy with fewer mistakes when we're moderately sleepy. The reason seems to be the same; with the other senses less alert and the mind concentrated on what is heard it comes easier. Ask the ops from any old one man seagoing job when they can receive the press best and they'll tell you it's easy after listening to various sparks until they're sleepy. Of course if the man who is pounding the key is sleepy the bets are all off, and if he is as rotten as a few I've heard lately you have to be wide awake and use the imagination half the time to know what he really means.

Maybe the foregoing observations don't apply to certain individuals who are deliberate and self-possessed at all times, but they certainly are true of the nervous type, who find it hard to concentrate. If this is your type, just try it some time. Turn the lights low or off, listen to the medley of dots and dashes until you are a little sleepy, and then hook up with a fast, steady sender who is putting over a lot of traffic and see how easy it is to copy.

—*E. P. Worden,*
Radio Editor, *Cleveland News.*

Eliminating Rubber Stamp Messages

601 Enterprise Bldg.,
Milwaukee, Wis.

Editor, *QST:*

While there are stations in operation and no important traffic to handle, there are bound to be "rubber stamp" messages. Unnecessary communication clutters up the air, and is an abuse of our great natural resource, the other. The solution to the problem of suppressing such practices, then, is found in the creation of important traffic. This is just what has been done in Milwaukee.

Robert E. Knoff, radio editor of the Milwaukee Journal originated the idea of having Wisconsin hams act as state correspondents for the metropolitan paper. In order to give the plan a trial, an experiment, lasting a month, is now in progress, at the end of which, five prizes, aggregating fifty dollars, will be awarded by the Journal. There will be a grand prize for the best all-around work by a station either at the receiving or transmitting end of dispatched, and two prizes each, for the best work in transmitting and receiving news messages.

Schedules are being worked out so that a Milwaukee station will be on every night, both before and after the quiet hours, and state amateurs will be organized so that any important news will be sent immediately. In order to solve the problem of publishability of news, upstate men are instructed to transmit important local news items of wide interest, from the latest edition of the newspaper in their town.

While amateurs have handled press work during storms and other emergencies, we believe that this is the first time that a systematic radio news gathering system has been organized for every day working.*

The system has many merits, among them: boosting message totals, increasing A.R.R.L. publicity, rendering a service to the public, making prizes available to the amateur, preparing amateur stations for emergency work, but greatest of all, freeing the air of unnecessary matter.

The writer will be glad to hear from anyone interested in trying a similar stunt in his town, and will answer any questions

—*Charles S. Polacheck,*
A.R.R.L. City News Correspondent, Milwaukee, Wis.

Likes QST

727 Boylston Street,
Boston, Massachusetts.

Editor, *QST:*

Congratulations, O.M., on the August

*This was done in California some years ago—Dept. Ed.

issue of *QST*—the best yet. It's a "grand and glorious feeling" when a new member comes in and you know before you tear the wrapper that you're in for two hours of unqualified joy!

QST is always good—but the August issue is better—the best prepared articles ever printed. Keep up the good work! 73's.

—*E. P. Gordon*
Adv. Mgr. Atlantic Radio Co., Inc.

Another Amateur's Opinion

210 West 102nd St.,
New York City, N.Y.

Editor, *QST:*

In your editorial in the March issue you expressed my opinion of the amateur game to a T. Because of the situation which you admirably stated, I have quit the amateur radio game as far as brass pounding and receiving is concerned. Two months ago I dismantled my set and sold everything in sight. Why? Just because I found things on the air just as you say only a little worse. Everyone I managed to raise would say "QTC? QRU pse QSL crd 73" Everyone, every blessed one sent the same thing.

This "pse QSL crd" thing is funny. I've heard stations only 100 miles away ask for cards. Stations that are heard in England, Holland, France, etc., ask stations in neighboring districts for cards, cards, cards.

Another thing. You ask a fellow to stand by for some tests. He says GA. You make a few changes and call him. N.D. You go back to the old setting and call him again. Still N.D. Again why? Well, I'm sure he absent mindedly on purpose lost you. I've asked for tests and have been told to GA and have come back only to hear the fellow at the other end call CQ or someone else.

As for message delivery, in the past six years I have had two of my messages delivered. I guess they got there by mistake. It seems to me that the weak point in message delivery is the actual handling of the message to the addressee. I have followed messages that I have sent right into the city of its destination, only to find that it never reached its goal.

I said I've quit the amateur game, but don't fear that I'll turn B.C.L. Never! I will argue with anyone that the amateur is essential but between you and I, OM, I cannot see a good reason for his existance. That is, the way he exists today. Believe me I'd give most anything for the good old spark days.

I've joined the experimenter's department and will try and help you when I can. I would like to see *QST* give as much room to the Experimenter's Section as it does to the Operating Department.

I have absolutely no ideas to offer but I had to write you and let you know how I feel about amateur radio. My opinion is that all the amateurs want today is cards, cards, cards;—to which they don't QSL.

—*Howard A. Chinn, 2CEG.*

Re: Poor Notes on Short Waves

U.S.S. Wood, No. 317

Editor, *QST:*

I notice in August *QST* a letter from Mr. West of 6IV-6ZP regarding poor notes on short waves.

About two years ago I had occasion to conduct some short wave experiments at station 9BZZ on waves from 110 to 150 meters and I noticed the same peculiarities in regard to the note.

The first thing I did was to change my grid leak from an inductive type to an old potentiometer of about 5000 ohms resistance. This helped some. Next I remodeled my plate condenser and replaced the tinfoil with smooth copper off of a 3 inch strip oscillation transformer. I also made the same changes in my aerial series condenser. Then my note was fairly clear but seemed to have an audio frequency ripple in it. This was overcome by using for a radio frequency choke one of Montgomery-Ward and Co.'s. Arlington loose coupler secondaries and tuning it till the ripple disappeared. This was on 110 meters. Of course it may not help in every case but is just a suggestion for experiment.

—*Deen. W. Imel,*
RM3C, U.S.N. ex 9BZZ.

Another Possible Reason

U.S.S. Litchfield, No. 336,
c/o Postmaster,
San Francisco.

Editor, *QST:*

In the August issue I noticed a letter from Mr. L. E. West (6LV 6ZP) in regard to poor notes on short wave sets.

It has been found that when using a motor generator for the plate supply that a filter which will completely eliminate the howls and ripples on a low frequency, will not do so at a higher frequency. One explanation is that the minute sparks produced on the commutator set up radio frequency oscillations the same as any spark transmitter. These are radiated by the wiring connecting the generator to the set. These radio frequency oscillations influence the grid of the oscillator tube in the same manner as the audio frequency ripple which we all know to be the ripple that gets through our 30 henry brute force beasts.

So it seems we must also build a good radio frequency filter to have a good note, as well as an audio frequency filter.

This filter may consist of two small coils, one in each DC lead, of from 5-10 turns shunted by a small capacity of approximate-

ly 002. Try your grid condenser but be sure it is a good one. The coils should be wound of heavy wire, best self supporting, and should be made rigidly. As the old man once said, "His soul longed for rigidity." The real reason is that if the coil is a flabby affair it is more likely to aid the radio frequency in harming your set, than it is in choking the oscillations. Another reason, flexible coils shift frequency too easily. The LC ratio tables may be used in design of the choke coil.

Now in the case of batteries of course the above does not hold true. The only thing is that any sparks from the battery may produce the same effect. These sparks may be so minute that we can not see them. They may be between parts of the battery we can not see. Anyway you fellows that are having trouble try a radio frequency filter, designed as above, and run some tests with another afflicted brother. You then find that some other coil form is better. If you do let me know.

Another thing that will help is to reduce the wiring from the high tension DC to the set. This gives less radiating surface for this ripple and of course will cut its effect on the rest of the set.

And finally please let me know how you make out.

—R. B. Conaughty, 8CUJ.

Crossing the Delaware

318 Gardner Ave.,
Trenton, N.J.

Editor, *QST*,

An experiment was held on Sept. 13th, with a long antenna on short and broadcast waves, in which I thought you might be interested.

At 7:30 P. M. a car was equipped with the necessary tuners and a two-step, and the gang proceeded to Yardley, Pa. which is about five miles from Trenton. There we decided to stretch the antenna across the Delaware River using the Reading Railroad Co.'s bridge as necessary. We anchored the New Jersey end of the antenna to the top of the bridge which was 90 feet high, and the other end, 1200 feet from the New Jersey end, led to a point three feet high.

After hooking up the set at about 9:50 P. M. E.S.T., broadcasting stations were heard from all parts of the surrounding country and Canada. Then the short-wave tuner was connected up. Results obtained on the short waves were not exceptionally good on account of the QRN as there was a bad lightning storm in this locality at 9 P. M.

We were determined to hear a "6" before quitting and, finally, with one-third of us (3HW) asleep and over half of the rest almost in the arms of Morpheus we managed to hear 6AWT, and so ended our night's vigil. At dawn we took down the antenna and proceeded home for a good "nights" sleep.

—A. G. Wentzel, Jr., 3HW
E. G. Raser, 3CS
E. P. Knowles, ex-3CP

(The list of stations heard on the above expedition appears in the "Calls Heard" department of this *QST*.—Dept. Ed.)

ANTENNA RESISTANCES

(Concluded from page 48)

ent because here the radiation resistance is naturally a very large percentage of the entire resistance. If one were to consider a straight vertical antenna situated out in a field well away from buildings and with a suitable counterpoise (preferably star-shaped, 5 or 6 wires) there should be no gain whatever from operating with a very high antenna which had to be operated a long way above its fundamental frequency. In fact, there should be a loss, due to an ohmic resistance. Then a further loss should be brought about in the manner mentioned in an earlier paragraph by the use of very small high-voltage condensers, which transfer the energy from the set to the antenna. It is much more comfortable to operate somewhat closer to the fundamental, although still preferably a little beyond. In the case of an antenna surrounded by many obstacles, there might be a real advantage in getting radiation started off at a fairly high altitude so as to overleap these obstacles and suffer less local absorption. There is also the question of further losses in the long antenna due to horizontal radiation, if any considerable portion of the antenna runs more or less parallel with the earth. This horizontal radiation will be very quickly absorbed, which means heavy losses. The question as to whether a very long antenna may be used effectively, operated a long way above its fundamental frequency, will have to be decided for each individual installation, but it is not believed that it has the advantage generally claimed for it. The more ideal antenna will be the short compact antenna system set well away from all obstacles or mounted with counterpoise on top of a building.

20 FT MAST

$10. PREPAID

Install this steel aerial mast for greater range and better results. Neat, substantial construction. 20 Ft. Mast, $10. 40 Ft. Mast, $25. 60 Ft. Mast, $45. Freight prepaid if remittance is sent with order—otherwise C. O. D. Write for circular.

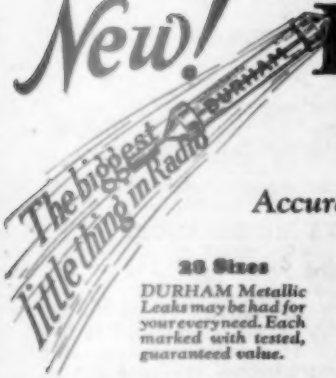
S.W. HULL & CO., 2048 East 79th Street, CLEVELAND, O.

New!

DURHAM Metallic Grid Leaks

FIXED—VARIABLE

Accurate — Permanent — Noiseless



28 Sizes

DURHAM Metallic Leaks may be had for your every need. Each marked with tested, guaranteed value.

Prices—Fixed, over ¼ meg. 50c
Fixed, under ¼ meg. 75c
Variable, to 0.1 meg. 75c
Variable, 0.1 to 5 megs. 75c
Variable, 2 to 10 megs. 75c
Mounts, single leak 30c
Cond. and leak 35c
Double, for resis. coupled amplif. 40c

ANOTHER important advance in radio—the development of a practical METALLIC high resistance for grid leak and resistance coupling! This is the invention of two professors in chemistry and electricity at a large eastern university.

The new DURHAM Metallic Resistance Unit is a rare metal deposited on glass by means of a complicated process developed after months of scientific research.

Tested and guaranteed accurate, every DURHAM unit is noiseless and non-inductive. You can depend upon them absolutely. They are the biggest little things in radio.

DURHAM Fixed or Variable Resistance Units (grid leaks) fit standard holders. But you will find the new style base more convenient. Three styles take care of plain mounting, grid leak and condenser mounting and double base for resistance amplifiers.

GET THIS RESISTANCE AMPLIFIER BOOKLET

Complete details for construction of the most perfect type of amplification. Coupling resistances and grid leaks for detector and two stages cost less than one good transformer. Send 25c for this useful booklet about the "biggest little thing in radio."

Satisfaction Guaranteed

DEALERS:—

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accuracy and price—plus publicity—are turning in the volume. Send for price sheet now.

DURHAM & CO., *Inc.*
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A new

RHEOSTAT

with immovable coils

The coils of the new Centralab Rheostat are firmly clamped between and imbedded in insulating material so they cannot move. This eliminates the noise in the set caused by lateral movement of coils, and maintains a uniform spacing between windings, giving smooth, even regulation and eliminating dead spots. The contact shoe cannot catch. Attractive in appearance, and substantial in construction. Single hole mounting.

No. 206—6 ohms maximum resistance . **$1.25**
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PYREX TRANSMITTING ANTENNA INSULATORS

Overall Length 7¼"
Developed Leakage Path 7"

Low Phase Angle Difference (0.3°)
High Mechanical Strength
No Absorption of Water

Invaluable for the Higher Frequencies

John L. Reinartz uses and recommends PYREX Insulators.

$1.50 Each C. O. D.

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INDUSTRIAL DIVISION
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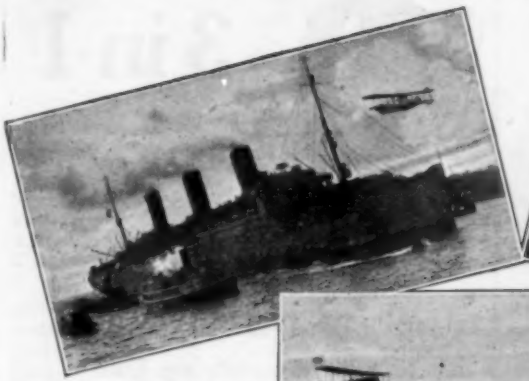

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Standard Equipment of United States Submarines

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Remarkable are the adventures of Burgess Radio Batteries. And where there's danger—upon, above, or below the earth, sky and sea, will be found Burgess Batteries—laboratory products.

"ASK ANY RADIO ENGINEER"

Write to 151 Burgess Engineering Building, Madison, Wisconsin, for the Burgess Radio Compass. It is amusing, unusual and useful.

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A copy of the I. C. S. Radio Operator's Handbook should be in every radio shack

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IT EXPLAINS: Electrical terms and circuits, antenna construction and calculation, generators and motors, batteries, detectors, relays, spark, arc, CW, ICW and phone transmission and reception, commercial, amateur and broadcast transmitters and receivers, codes, license rules. Many other features.

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Improve the looks of your set, and learn what real amplification is. 4-1 ratio.
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When ordering advise if 8 or 30 ohm rheostat wanted.

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LOUD SPEAKER

This is known everywhere as the Loud Speaker with the quality tone. Not only is the tone natural and without mechanical distortion, but is sufficiently big in volume to be easily heard in a large room or all through the house. Comes to you ready to use—no auxiliary batteries are required.

Made in three models:

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Price $30.00

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Bulletin AX-3014 describes these Loud Speakers.

This is the Baby Audiophone equipped with the Fiber Horn which is now standard and supersedes the metal flare previously used. **Price $12.50**

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Distance covered in record time while all the world wondered. News received in one part of the country only a few weeks after it was sent from another. That was the pony express.

Today, news, messages, entertainment—all are instantly brought from all over the land right to your home by the Pony Express of the air—Crosley Radio Receivers. New York hears California. Florida listens to Hawaii. Canada converses with Mexico. North Dakota keeps in close touch with the MacMillan expedition at the North Pole. Such are the daily performances of Crosley Receivers as told by hundreds of unsolicited letters from happy users.

At bringing in distant stations in a clear, enjoyable manner, Crosley Instruments, each in its own class, have proven themselves unexcelled. Yet they are the lowest priced radio receivers ever offered. For satisfactory results, real radio value, you can't beat a Crosley.

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Better-Cost Less
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CROSLEY TRIRDYN 3R3
$65.00

The Trirdyn 3R3 incorporating radio frequency amplification, regeneration, reflex and additional audio frequency amplification will, with only three tubes, give performance equal to the customary four and five tube set. Will easily tune through local broadcasting to bring in long distant stations on the loud speaker.

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The Crosley Radio Corporation owns and operates Broadcasting Station W L W

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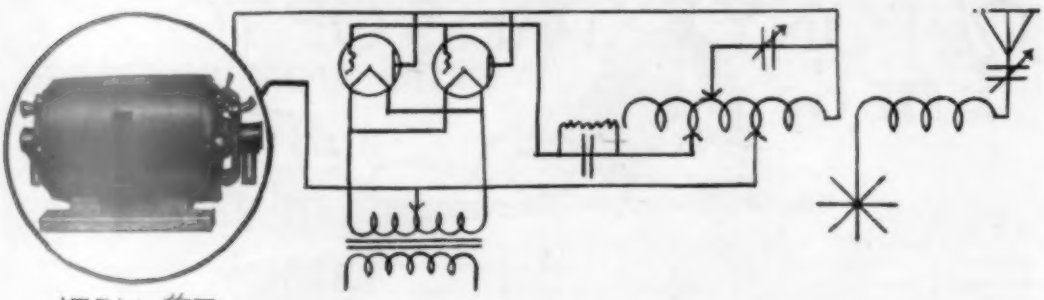

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For maximum mileage per watt—try "ESCO."

Write for Bulletins 237B and 242 B listing over 200 combinations.

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225 SOUTH STREET — STAMFORD, CONN., U. S. A.

Pioneers in Developing and Perfecting High Voltage Radio Apparatus

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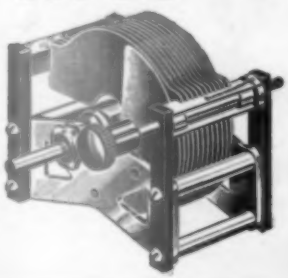
HICO *Designed for you by 5 Engineers!!*



At last, a variable condenser that has all of the very best features a good condenser should have. No more guess work. Works equally well in any circuit. Extremely low loss. A beautiful instrument.

Noiseless cam vernier on stator plates, exclusive feature.

11 plate	.00025 mfd.	$4.50	each
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Send for one, you'll be satisfied.

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Now—You Get What You Want!

This set of socket wrenches, just the VALUE you've been waiting for. And note these points:

SIX radio sizes ¼" to ½" to the set. Each size COMPLETE with PERMANENT handle. Hollowed stems; accurate hexagon heads. Packed in a strong, slide cover WOODEN box.

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The shell is ORANGE
Bakelite—the base genuine Thermoplax

At Last—A Radio Socket Worthy of This Famous Trade Mark

After months of experiment and research the Cutler-Hammer engineers announce this masterpiece of radio socket design. With features never before found in any socket, it brings to your set a degree of efficiency that means added miles of range and hours of clearer, more enjoyable reception.

Capacity has been absolutely minimized—without sacrifice of mechanical strength, and its base of ebony black Thermoplax in beautiful color contrast with the thin shell of orange Bakelite adds as much to the appearance of any set as this socket's construction does to its efficiency.

You'll like all of its many exclusive features—the silvered bronze contacts that afford *permanently* perfect contact; the slotted binding nuts; the handy terminals for soldering; the wide spacing of current carrying parts.

You'll like its appearance—neatness—small size. You'll like the way the tube is inserted and removed without twisting. And best of all, you'll like the price, 90c. *This socket that meets the specifications of the most exacting radio engineer costs no more than most of those on the market today.* Until all dealers have been stocked, you can be supplied direct from the factory at the retail price plus 10c for packing and postage. Be sure you have the genuine—it will pay you in every way to refuse all substitutes.

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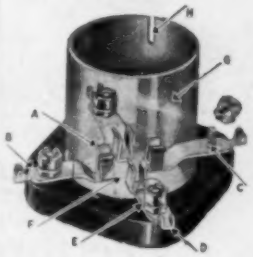
C-H

These Exclusive Features Assure Better Reception



A
Perfect contact. Both sides of tube prong cleaned when inserted—no contact or wear on soldered end.

B
All metal parts *silver* plated—perfect contact for the life of the set. Silver may tarnish but its contact resistance does not change.

C
One piece contact construction. The binding post is NOT a part of the circuit—the wire to the socket always touches the contact strip which carries the current direct to the tube prong—no joints to cause losses.

D
Convenient terminals for soldering—full length to allow bending down for under-wiring. Ears hold wire in place for soldering.

E
Extra handy binding posts—tight connections with either wrench or screw-driver. Lock washers hold terminals rigid.

F
Wide spacing of current carrying parts both in air and insulation—true low-loss construction.

G
A minimum of both metal and insulation for low capacity. Shell of thin Bakelite—the base of genuine Thermoplax.

H
The tube is held in place by merely a vertical motion—no twisting to separate bulb from base.

The attractive orange shell helps identify this better socket, but the famous C-H trade mark both on the socket and on the orange and blue box is your genuine protection.

C-H **RADIO · SOCKET ·**

The FIRST and ONLY six tube radio receiver to bring in any desired station by a *single* turn of a *single* control to a *single* pre-determined dial setting, with a purity of tone and clarity unmatched by any other receiver.
Thermiodyne appeals particularly to the non-technical man or woman who wants perfect performance with easy operation. It may be used with any type antenna, or, under favorable conditions, with none; with dry or storage batteries and with any make tubes.

14 Points of Thermiodyne Supremacy

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9—Thermiodyne picks them at the Exact Setting Every Time
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13—Distance, Volume, Clear as a Bell, Without fuss or excuses
14—A 180 degree Turn of the Single Control is like an Instantaneous Tour of Dozens of Cities

Beautifully built in exquisite genuine mahogany cabinet with space for all batteries for dry cell operation. **$140**

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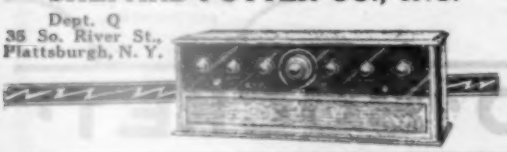

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AmerTran AF-6 (Turn ratio 5), for use in the first stage of amplification.

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Price, either type, $7. at your Dealer's.

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Celoron panels come cut in nine sizes, in black, mahogany or oak. Other sizes cut to order. Ask your dealer.

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Clear and distinct

Indistinct, hazy

It's a Difference of *Clearness*

HOW often when listening in, you've tuned and tuned and still have not been able to get the voice or instrument to sound clear, distinct and natural.

The real big difference between the N & K Imported Loudspeaker, Type W, and ordinary speakers lies in the fact that N & K reproduces *all there is to the music*, bringing out delicate high tones as well as deep low ones, clear and distinct, exactly as the musician sings or plays them. There is no exaggerated loudness, no blurring, twanging, rasping, droning, rattling, disagreeable tone.

This is a loudspeaker of an entirely new type. The shape and finish are new and artistic, harmonizing with any style of home furnishing. The material is new—*burtex*, a lightweight rigid substance made scientifically to eliminate counter-vibration. And the speaker is so skilfully designed that it fills the entire room with its music instead of concentrating in one favored direction.

This new type of speaker bids fair to revolutionize every idea the public now has on speakers. So confident are we that it is the speaker the public has been waiting for, that we authorize dealers to allow responsible customers to try out the N & K Imported Loudspeaker with their own sets, in their own homes,

FREE OF CHARGE FOR 5 DAYS

Ask your dealer to let you hear the new N&K Imported Loudspeaker, Type W. If he is not supplied, write us. We'll tell you where you can see this new invention.

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N&K Imported Loudspeaker Type W, $27.50

N&K Imported Phones Model D, 4000 ohms, $8.50

N&K Imported Phono Unit. Attaches instantly to any phonograph, $7.50

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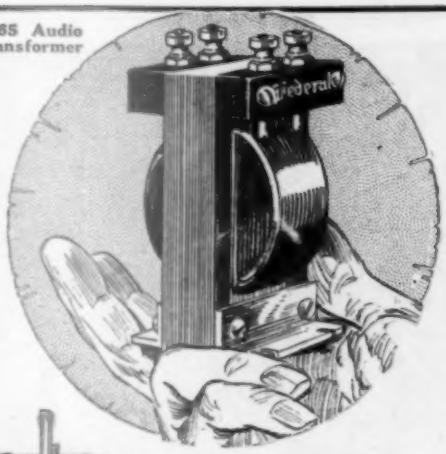
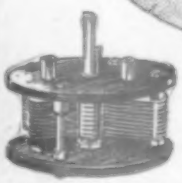
LOUDSPEAKER
TYPE W

Stands 14 in. high. Choice of handsome color schemes. Send for free folder, "The Speaker You Have Waited For"

No. 65 Audio Transformer

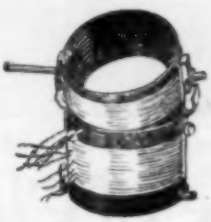




Variable Condenser

Look for this sign

Federal RADIO



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THE famous Federal No. 65 Audio Frequency Transformer and over 130 other standard radio parts now bear the Federal iron-clad performance gurantee. If you want exceptional tone beauty, selectivity and distance range in your home assembly, insist that each part bear the Federal Guarantee.

A Book "The Radio Work Bench" aids you in avoiding construction pitfalls. Sold by Federal dealers—25c—Canada—35c

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Standard RADIO Products

NOW IS THE TIME, AMATEURS !

To Do Your Experimental Work on Your Receivers in anticipation of Better "DX" This Winter

Parts of every description and at prices that are right to rebuild or add to your present equipment.

You Will Work EUROPE THIS WINTER With A Good Set—

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Variometers	Reinartz coils	Formica Panels
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WD-11	$2.50	DV-6A	$2.50
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UV-200	2.50	C-299	2.50
UV-201	2.50	UV-201A	2.50
C-300	2.50	C-301A	2.50
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DV-1	2.50	UV-202 Transmitter	4.00
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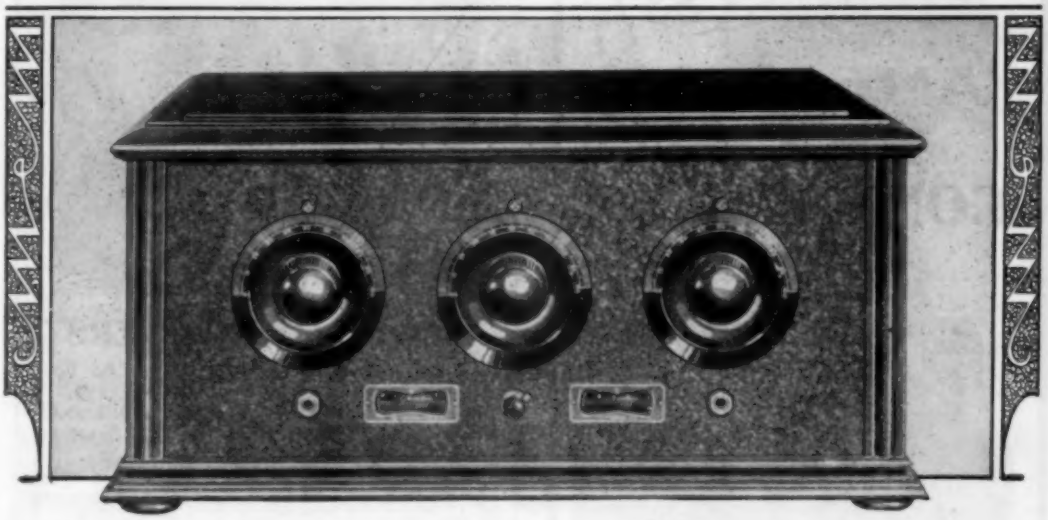
ELECTRICAL EQUIPMENT



Announcing the 6-D Receiver

TYPE 6-D embodies the most modern developments in radio engineering, together with unusual design and workmanship. It meets exacting requirements of discriminating buyers.

The outstanding characteristics of this new Receiver are extreme selectivity, extraordinary distance range and exceptional clarity. Tuning is very simple. The 6-D is a non-oscillating Receiver, and no potentiometer or stabilizer is employed.

Step into a radio store and examine this new Receiver. Ask for a demonstration, and see for yourself its many superior qualities.

SPECIFICATIONS

Circuit: Two stages of tuned radio frequency amplification, detector and two stages of audio frequency amplification.

Tubes: Five in all. Jacks provided for either five or four tube operation.

Batteries: Either storage or dry-cells.

Cables: Complete set supplied for "A" and "B" batteries.

Aerial: 75 to 125 feet, single wire.

Price, without Tubes & Batteries, $125.00

Wave lengths: 200 to 600 meters, with uniform efficiency of reception.

Panel: Aluminum, with attractive crystal black finish. A perfect body capacity shield.

Dials: Sunken design. Shaped to fit the hand and permit a natural position in tuning.

Rheostats: Adequate resistance for all standard base commercial tubes.

Condensers: Single bearing, low leakage losses.

Sockets: Suspended on cushion springs which absorb vibrations.

Cabinet: Mahogany, with distinctive lines and high finish. Ample space provided for "B" batteries.

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A Whirlwind Success!

AMERICAN BRAND CONDENSERS

with the **100 to 1** *Worm Drive*

23 Plate, only $5.00

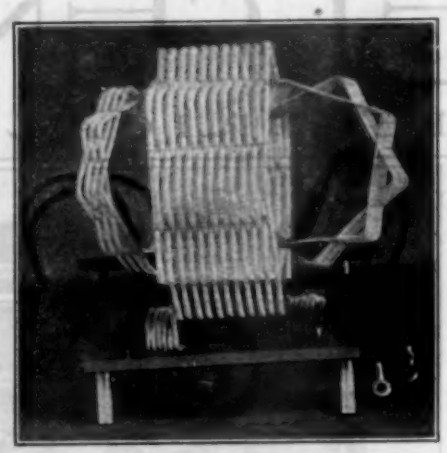
Praised by experts everywhere and acclaimed by the Public, the American Brand Worm Drive Vernier Condenser is the sensation of the radio world.

The highest ratio geared adjustment ever developed on variable Condensers makes the loss on American Brand practically *zero*.

The price is no higher than of ordinary condensers. Ask your dealer to show you one. If he can't do so, write for descriptive folder and send us his name.

NOTE TO DEALER: If your jobber can't supply you, write us—

American Brand Corporation
8 West Park St., Newark, N. J.
Factory—Philadelphia



LOW LOSS TUNERS

Amateur 70 to 225 meters. $10.00 Grid coil wound with No. 12 wire. No taps.
Broadcast 180-600 meters $10.00 Broadcast tuner supplied with either fixed or variable antenna coupling.
Tuned R. F. transformers 200-600 meters $3.00. We pay parcels post and insurance in U. S.

Davenport Radio Laboratories,
647 CEDAR ST. DAVENPORT, IA.

100 Volt Type

YOUR MONEY BACK IF YOU'RE NOT SATISFIED WITH KIC-O

We have thousands of unsolicited letters of recommendation. KIC-O "B" batteries will make good for you, too. Life unlimited. Not harmed by short circuiting, overcharging, idleness. Panel switches give single cell variations. Recharge from any 110-volt A.C. line with small home-rectifier. Charge lasts 3 to 6 months in detector plate circuit.

Volts	Price Plain	With Panels
22	$5.50	$.....
32	7.25	11.75
48	9.50	14.00
68	12.50	17.00
100	17.50	22.50
145	23.50	28.50

Mounted Rectifier.....$2.50
Unmounted Rectifier...$1.50

GUARANTEE

Your money back on any KIC-O Battery if not satisfied within 30 days. Write for full information on "A" and "B" Batteries.

Kimley Electric Company, Inc.
2666 MAIN STREET, BUFFALO, N. Y.

KIC-O Storage "B" Batteries—long service, low cost.

Amazingly Different!

Music lovers from coast to coast have learned to divide all Radio Reproduction into two broad classes.

One class is the reproduction supplied by The Superspeaker.

The other is the wide variety that comes from all the rest of the so-called loud-speaking devices.

Between these two classes yawns a veritable Grand Canyon of Acoustics—the difference between real music and mere noise. Such is the verdict Jewett owners everywhere proclaim.

We can easily understand this verdict, for we know the reasons which cause this amazing difference.

These reasons have their beginnings in such fundamentals as dimensions, materials, workmanship and the application of acoustical engineering, available only to experienced musical-instrument men.

Not in even one of these fundamentals does the market include a duplication of The Superspeaker. Until the advent of some other instrument which can duplicate our product not in one but in every fundamental, the present chasm cannot be bridged.

JEWETT Quality Products

No extra batteries—nothing to get out of order—Each Superspeaker shipped in individual carton—

Vemco Reproducing Unit also furnished separately for Phonogragh Adaptation.

Get our dealer proposition in time to cash in with Fall Demand.

THE JEWETT RADIO & PHONOGRAPH CO.
5680 Twelfth Street - - - Detroit, Michigan

The Superspeaker,

Harold Bolster
on behalf of the Principal Radio Manufacturers and Dealers of America
Presents

This greatest radio show ever held will be *profit-sharing with exhibitors*

Special Election Week Program Features

Featuring, *in advance*, the most striking developments in the Radio art and the Radio industry for the coming year

—Receiving Set Models for 1925

—Phonograph Radio Combinations for 1925

—Improved Equipment for 1925

(Main and Mezzanine Floors)
NEW YORK CITY
"The World and his Girl will be there"
AMERICAN RADIO EXPOSITION COMPANY
Director: HAROLD BOLSTER *General Manager:* J. C. JOHNSON
522 FIFTH AVENUE, Telephone: Vanderbilt 0068 NEW YORK

Log Every Worth While Station with Perfect Ease

Be able to get the programs you like best any time and with that smoothness and clearness of tone that makes Radio most enjoyable. It's easy with

Stromberg-Carlson

HEAD SETS and LOUD SPEAKERS

Their powerful magnets give extreme sensitivity. The layer wound and layer insulated coils enable these instruments to stand up under the highest voltages and to retain their sensitivity permanently.

Ask your dealer

STROMBERG-CARLSON TEL. MFG. CO., Rochester, N. Y.

The Model OEM, DAY-FAN Receiving Set

Model OEM-7, Four Tubes—$98.
Model OEM-11, Three Tubes $90

This set is worthy of your immediate attention.

It has the Duo-plex circuit developed in our laboratories. So perfectly balanced is this set that the dial settings are the same EVERYWHERE, EVERYTIME. It has a very low maintenance cost. Write today for full particulars.

The Dayton Fan & Motor Company, Dayton, Ohio.

Manufacturers of high-grade electrical apparatus for 35 years.

The RED SEAL VARIABLE CONDENSER

At Last—an ideal vernier to control a low-loss condenser

You have probably often wished for such a combination. Now for the first time the vernier of the Red Seal enables you to easily take full advantage of high condenser efficiency without turning right through the sharp peak of the wave.

No more slipping, lost motion, or tight bearings. No more tuning with one knob and adjusting with another. All the adjusting may be done with the vernier knob alone.

The above does not give you an adequate picture of the Red Seal Condenser. Go to your dealer and ask to see it. As you operate the vernier for yourself, note these six important features which make it the ideal control for this efficient, low-loss instrument.

1. The action of the vernier is *positive*, giving delicate, smooth adjustment.
2. There is no lost motion or play at any point.
3. All tuning may be done with the vernier alone.
4. Only one dial setting—stations easily logged.
5. There is no fibre, rubber, or gears. Nothing to wear or get out of order.
6. Plates turn freely. Balanced vernier eliminates need for friction at bearings.

The Red Seal has four other points of note:

1. Plates are of brass and are *soldered*.
2. Spring "pig-tail" connection employed.
3. End plates are grounded, eliminating the effect of hand capacity. For supercritical work, insist on the Red Seal Variable Condenser.
4. To facilitate tuning the movable plates are given a special shape, making the Red Seal of the "straight-line" type.

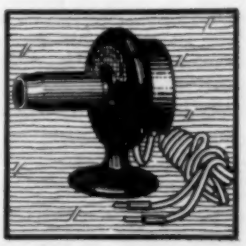
Manhattan Electrical Supply Co.
Incorporated
New York Chicago St. Louis
San Francisco

Manhattan
RADIO PRODUCTS

MADE BY THE MAKERS OF THE FAMOUS RED SEAL DRY BATTERIES

Manhattan Junior Loud Speaker—A real musical instrument containing a specially designed reproducer unit for loud speaker work. Not just a headset in a base. Has "Concert Modulator" adjustment giving best results under all conditions—**$10.00**

Red Seal Headset—Designed for "DX" work. Tone quality excellent. Workmanship the best. No distortion or chattering. Bakelite case, soft rubber sanitary headband—**$6.00**



Red Seal Phonograph Attachment—Makes a loud speaker of your phonograph. A high grade reproducer reproducing the work of the broadcasting artists with fidelity—**$5.00**

Red Seal Batteries—The dependable dry battery for "A" circuits. Long operating life and great recuperative power make Red Seals ideal for radio work. Sold by all classes of dealers. Remember, *fresh* Red Seals bring in fresh stations.

Greiff says:

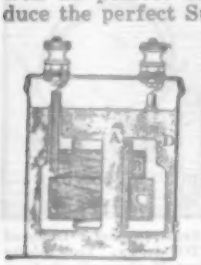
"Watch your losses and the signals will take care of themselves."

RECEPTRAD

Replacement parts for the

SUPER-HETERODYNE

are engineered to Super-Heterodyne standards under the personal supervision of Lieut. Victor Greiff. Their efficiency and minimum losses as well as perfect construction combine to produce the perfect Super-Heterodyne.



Cross section view of the Receptrad Super-Heterodyne Transformer, type 1716.

The special core A is of compunited iron and forms a closed field. The primary B, is so wound with respect to the secondary C, that it affords the maximum step-up in signal voltage. Both are "Herring Bone Windings," a patented type used only by Receptrad. The field is further shielded by a magnetic path D, and is metallically isolated from external fields by the case E.

The Receptrad transformer is a victory for the steel core type but a greater victory for Receptrad because its efficiency exceeds by far any similar intermediate frequency coupler. $8.50 each.

Oscillo Coupler—maximum inductance in minimum space. Two coils, one takes energy through loop, while the other feeds its energy to first detector. Price, $6.00.

Tuned Filter Coupler-two low loss coils, similarly tuned to correspond with intermediate frequency transformer's best range. No interference—Real selectivity. Price $7.50.

Other RECEPTRAD parts for the Super-Heterodyne are 1 Audio Transformer, Type AT3 $3.75. 1 Audio Transformer, Type ATX $5.75. 2 1MF By-Pass Condensers, Type G-1000 $1.50 each. Price for all parts $53.50.
Lieut. Greiff's famous Super-Heterodyne Manual, $1.50

FREE Ask your dealer or write for free blueprint No. 3 of the Famous Greiff 8-Tube Super.

RADIO RECEPTOR CO., Inc.
59 Bank Street — New York

Increased Signals

ACCURATE, constant, unchanging condenser capacity is demanded for greatest possible selectivity, clearness and loudness. Ben Franklin Micadensers, of all-metal and mica construction are individually tested by a special direct reading instrument. Accuracy guaranteed within 10% or your money back.

Made in all standard capacities. Most popular capacities priced as follows:

.0001	35c	.001	40c	.006	75c
.00025	35c	.002	40c	.015	$1.75
.0005	35c	.005	60c		

.00025 with Brackets for Grid Leaks . . 45c
.00025 with Self-contained Grid Leak . . 50c
.00025 in Matched pairs, per pair . 95c

(Both condensers warranted exactly same capacity)

We will furnish any *exact capacity value* in Micadensers, or *duplicate the capacity value of any condenser* you send us, at 10c above regular price.

At all good Jobbers and Dealers. If dealer can't supply, Ben Franklin Micadensers will be sent prepaid, on receipt of remittance with order.

The Ben Franklin Radio Manufacturing Company
Corner E. 27th and Superior — Cleveland, Ohio

In She Comes!

TIP your whisker to almost any point of an NAA Meter tested crystal and the full flow of the impulse instantly hits your phones, clean, clear, steady.

Reason—no guesswork in the test;—every, EVERY crystal meter-tested singly by specially made electrical instruments to a point away beyond normal sensitivity. In addition, the Newman-Stern mounting is new—patents pending—cold assembly, provides for refilling, and avoids damage to crystal by hot alloy; recessed for protection.

Perfect for Reflex

At all good jobbers and dealers, in neat turned wood box, 60c. If dealer can't supply, order direct and send dealer's name.

The Newman-Stern Co.
1746 East 12th Street
Cleveland, Ohio

Originators of tested crystals in 1914.
Oldest and Largest Producers.
Pioneers in Radio Equipment in Ohio

PAT PEND

New NAA Meter Tested Crystals

Nuggets of Sensitiveness

METER TESTED
NEWMAN-STERN

BAKELITE

TRADE MARK REG. U. S. PAT. OFF.

Crosley *and* Bakelite

The Crosley Radio Corporation of Cincinnati produces radio sets at reasonable prices, with no sacrifice of quality. The use of Bakelite not only provides dependable insulation but simplifies quantity production.

Bakelite is mechanically strong, impervious to moisture and its color does not fade. Its properties are unaffected by climatic conditions and it does not deteriorate with age or use.

In both the laminated and molded form, Bakelite is standard insulation for radio.

Write for a Copy of our Radio Booklet C.

BAKELITE
Condensite
REDMANOL
are the registered Trade Marks for the Phenol Resin Products manufactured under patents owned by
BAKELITE CORPORATION

Send for our Radio Map

The Bakelite Radio Map lists the call letters, wave length and location of every broadcasting station in the world. Enclose 10 cents to cover the cost and we will send you this map. · Address Map Department.

BAKELITE CORPORATION
247 Park Avenue, New York, N. Y.
· Chicago Office: 636 West 22d Street

THE MATERIAL OF A THOUSAND USES

JEWELL

No. 64
RADIO FREQUENCY AMMETER

Transmitting set Instruments

¶ We don't believe that there is an amateur in the U. S. or Canada who is not familiar with Jewell Instruments. Most of them are and depend on them for their work.

¶ **"The Jewell Trio"** is famous among amateurs:—We refer to our Nos. 54, 56, 64 and 74 uniform size instruments for transmitting set panels.

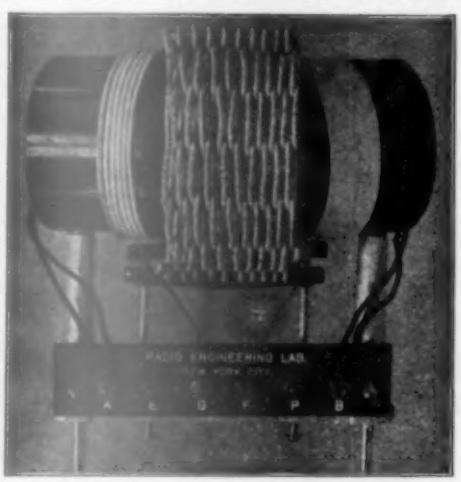
¶ We want every amateur in the world to write for our 15-A Radio Instrument Catalog.

Order from Dealer

Jewell Electrical Instrument Co.

1650 Walnut St. - Chicago

"25 Years Making Good Instruments"



LOW LOSS TUNER UNIT

MOST EFFICIENT TUNER AVAILABLE
REAL DX. RECEPTION
EXTREMELY SHARP TUNING TWO TYPES
AMATEUR—45 to 225 METERS WITH TAP
BROADCAST—250 to 550 METERS

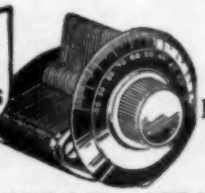
Special Types may be Furnished for the Very Short Waves

Price $10 each *Write for Information*

A. C. LOPEZ & CO.

Sole Distributors
334 FIFTH AVENUE, NEW YORK CITY

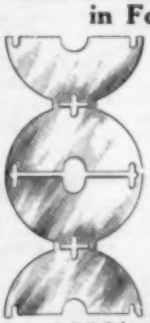
U.S. TOOL CONDENSERS
TRADE MARK



Point Number One

ONE PIECE STATOR

One of Several New Features in Four New Types



Stamped out of one piece of aluminum—the one piece stator eliminates broken contacts and soldered joints. Positive results—no leakage. Found in types 3 and 4, celoron end plates, and types 5 and 6, *low loss—metal end plates.*

ASK YOUR DEALER to Show YOU the ONE PIECE STATOR and other Improvements.

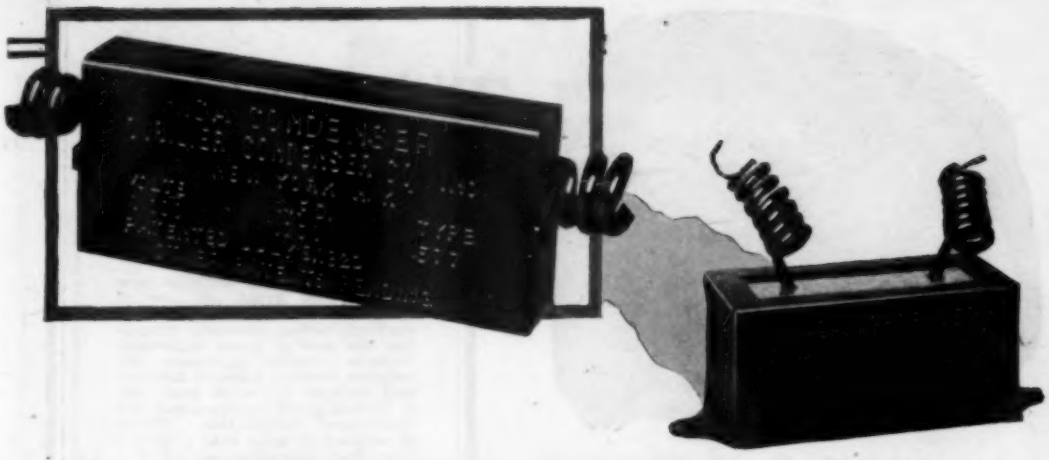
100% GUARANTEED

Write for Booklet

U. S. TOOL COMPANY, INC.

112 Mechanic St., Newark, N. J.

Mfrs. of special tools, dies, jigs, automatic machinery and sub presses



The Army and Navy Equip with
DUBILIER CONDENSERS

Ships at sea—cut off from the world. Far away regions of the frozen north—miles from civilization. These are the places that literally depend on radio for communication and life. And wherever there are government stations you will find Dubilier condensers. The government knows that they are absolutely dependable for efficient transmission under all conditions.

Types 577 & 580 are efficient condensers of fixed capacity and low loss. They are manufactured under a patented process that maintains permanent capacity and assures steady service. Amateur low power tube transmission with Dubilier Condensers insures the same unfailing service that the government stations achieve with higher power.

Ask your dealer about them or write us for information at 49-51 West 4th Street, New York, N. Y.

Dubilier

CONDENSER AND RADIO CORPORATION

MAHOGANITE
Dials that Match the Set

Like all other distinctive products, Mahoganite has its imitators. But, these imitations are on the surface only. Mahoganite is not a surface finish. The electrical values of Mahoganite extend through the material.

The only way to assure yourself of genuine Mahoganite Panels, or Dials which match the panels is to make sure that the RADION Trademark is on every one that you buy.

21 Stock Sizes

Mahoganite and Black

6 x 7	7 x 14	8 x 26
6 x 10½	7 x 18	9 x 14
6 x 14	7 x 21	10 x 12
6 x 21	7 x 24	12 x 14
7 x 9	7 x 26	12 x 21
7 x 10	7 x 30	14 x 18
7 x 12	7 x 48	20 x 24

RADION
The Supreme Insulation
PANELS

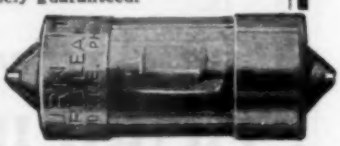
Look for this stamp on every genuine RADION Panel. Beware of substitutes and imitations.

AMERICAN HARD RUBBER CO.
11 MERCER ST. NEW YORK

TURN-IT
ADJUSTABLE GRID LEAK

Changes the Range of Resistance to Suit the strength of Reception

Constructed along entirely new lines which avoid all use of graphite or carbon and the microphonic noises generally attending the use of these materials. Turn-It greatly increases the volume, secures greater distance and reduces noises in your set. A Turn-It gives constant and undiminished satisfaction. There is nothing to wear out. Absolutely guaranteed.



Turn-It Grid Leak Is Only $1
At Your Dealer or Direct from Us.

TURN-IT RADIO SALES, Inc.
30 Church Street, N. Y.

FREE
Greatest Catalog of Radio Bargains

Send for It Today

It contains a thousand bargains of everything in radio: parts, supplies, complete parts for sets, complete sets, etc., also a mine of very latest information on all different circuits, complete list of broadcasting stations and other valuable data. Send your name and address and we'll send FREE catalog.

American Bell Loud Speaker

With American Adjustable Unit. Wonderful volume, clear reception. Speaks for itself without coaxing. 10-inch bell—made of non-vibrating material.

$3.95 Without unit
$6.95 With unit

$2.45

HEADPHONES
"RandolphSpecial"

2200 Ohm moulded headset, properly designed to give strong and clear reception. Biggest headphone value ever offered.

Hundreds of Other Bargains

Our catalog is filled with bargains like these. Order direct from this ad. We prepay charges. Don't buy anything in radio before you see our catalog. **FREE Service Dept.**

RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 32 CHICAGO, ILL.

Westinghouse presents a new "B" Battery

Designed for multi-tube sets, compact in size, large in capacity, this new "B" Battery offers you the following distinctive advantages:

A one-piece crystal glass container affords you at all times a view of the interior.

Easily recharged at slight expense.

No leakage from cell to cell.

Will not pump acid.

Bird cage plates insure long life and steady reliable service.

Large acid space requires less attention.

WESTINGHOUSE UNION BATTERY CO., SWISSVALE, PA.

WESTINGHOUSE

RADIO

"A," "B" and "C"

BATTERIES

MEETING THE NEEDS OF A. R. R. L. MEN EVERYWHERE

There is a Weston Indicating Instrument to meet every Radio need whether it be for Reception or Transmission. Voltmeters, Ammeters, Milliammeters, Thermo-Ammeters and Thermo-Galvanometers, in low or high range, or in small or large size are available for the amateur, advanced experimenter or commercial station.

Whatever your special requirement or problem may be, get in touch with us, and let us send you full particulars, and prices on the instrument or instruments exactly suitable to your needs. Weston 280 volt-ammeter, is also specially designed for testing tube characteristics, general circuit conditions, for measuring resistance, filament voltage, plate voltage, etc.

Antenna Ammeter

Weston Instant Change Plug

Weston Instant Change Plug

The original Instant Change Plug. 75 cents everywhere. Interchangeable from headphones to loud speaker in two seconds. No tools. The choice of A.R.R.L. men everywhere. Circular J is an attractive 24-page booklet that explains in detail all Weston Radio Instruments and shows instrument connections, for both transmitting and receiving sets. Sent free on request.

WESTON ELECTRICAL INSTRUMENT CO., 158 Weston Ave., Newark, N. J.

Electrical Indicating Instrument Authorities Since 1888

WESTON

STANDARD - The World Over

$5.00

One Model
One Quality
In Canada $7

America's Best Headset regardless of Price

We challenge comparison with America's best known headphones. Globe Phones always show up best where the opposition is greatest. And the quality is there to last for years.

There is long experience in making hearing aids for the deaf behind the amazing tone purity and reaching qualities of Globe Phones.

As beautiful as they are efficient. Leather covered head bands, heavily nickeled parts, extra powerful magnets. If your dealer fails you, write us.

Sales Department
The Zinke Company
1323 S. Michigan Ave.,
Chicago

Manufactured by
Globe Phone Mfg. Co.
Reading, Mass.

The Standard of the World~

The base-type
Freshman Variable Grid Leak
is the standard for those who build their own sets. It is the most compact and being entirely sealed it always remains unaffected by any climatic conditions.

Complete with either .00025 or .0005 Freshman Condenser— **$1.00**
without condenser..... .75

At your dealer's, otherwise send purchase price and you will be supplied postpaid

Chas. Freshman Company, Inc.
106-7th Ave., New York

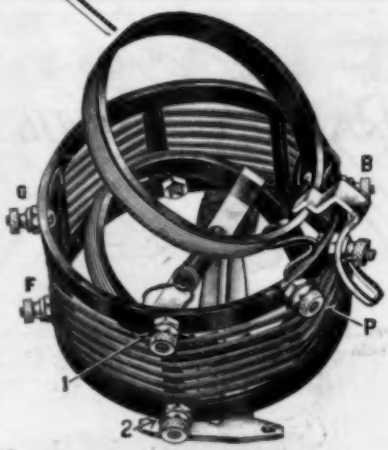
Copper-Brass & Fibre in Sheets, Rods & Tubes.

Machine Screws, Dies, Taps, and drills.

ANGIERS. U. S. A.
MONROE STREET PLANT
STREATOR, ILLINOIS.

What is the Most Popular Circuit?

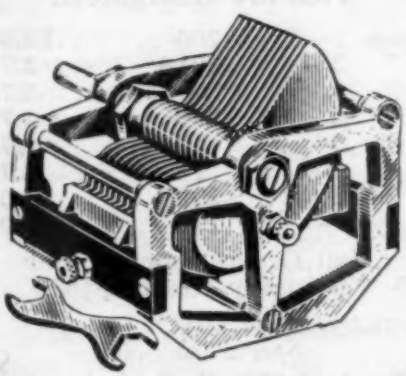
A recent survey of home made sets indicates that by far the most popular circuit—giving greatest satisfaction to the greatest number—is some form of tickler feed-back. For such circuits the B-T Low Loss Tuner is without an equal--in fact, it is without comparison



The "B-T" is the first Low Loss Short Wave Tuner. Type SW Covers 50 to 150 meters with a B-T 11-plate Type L Condenser. Type B covers 200 to 565,—no taps in either case, and the price is $5.00.

The adjustable untuned primary coil is the latest exclusive feature. A fixed adjustment can only approximate local conditions. With the new B-T Tuner you can adjust your primary to suit various types of antenna, circuit requirements and local receiving conditions,—any degree of coupling may be secured giving either increased selectivity or greater signal strength. When once adjusted to meet your requirements, no further change is necessary.

Bremer-Tully "Lifetime" Condenser



The World's Best

A Laboratory type condenser at a commercial price. It is the only Low Loss straight line wave length condenser. Go to your dealer and look it over, and you won't be satisfied till you own one.

"Better Tuning" (now in 6th Edition)

Tells you why and shows you how.
Complete instructions and diagrams for progressive constructions for Crystal to Reflex and Radio Frequency Circuits. Sent on receipt of 10c.

150 m.m.f. (7 plate)	$4.25
250 m.m.f. (11 plate)	4.50
520 m.m.f. (23 plate)	5.00
800 m.m.f. (35 plate)	6.50

BREMER-TULLY MFG. CO.
531 S. Canal St. Chicago, Ill.

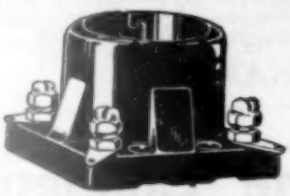
Fleron
Radio Specialties

VERNIER ADJUSTER

The best adjuster on the market. Spring holds head away from dial when not in use. With slight adjustment spring can be made to hold head against dial if desired. Patented. 65c

STAND-OFF INSULATOR

Fills the much-needed requirement for a strong, good-looking and practical stand off insulator. Meets every requirement of the Board of Fire Underwriters. $1.25 ea.



PORCELAIN SOCKETS

Lowest losses of any socket. Very carefully made. Black Body, Black Glaze. Side and bottom contact springs of reinforced phosphor Bronze, Solder Tabs. Cap Nut for screw driver or Spintite Wrench. All parts nickel Plated. 65c each.

PORCELAIN INSULATORS

Lowest power losses in the antenna Dielectric absorption reduced to minimum because of very low phase difference of Fleron Porcelain. Very tough body. Solid Black Glaze. Seven sizes, 20c to $1.00. Each insulator in a separate carton.

For Sale by all Good Jobbers and Dealers

M.M. FLERON & SON, Inc.
TRENTON, N.J.

LANE 100 Volt
Non-Acid Storage
"B" BATTERY

Makes a wonderful improvement in your radio set. Gives it more life and pep. Makes listening in a real pleasure. Gives a clearer reception than you have ever experienced. Brings in more stations louder and clearer, takes the guesswork out of distance reception.

Life of Battery Unlimited

No deterioration—easiest, quickest to charge—**will operate a 3 tube set continually for over 50 hrs.** Ordinary use one to four months without recharging.

PANEL SWITCHES **Gives Instant and Correct Voltage**

A great and necessary improvement on batteries. **Gives instantly correct voltage** at all times and perfect reception. Allows for charging in two equal parts. Comes in handsome indestructible case, **$25** At your dealer's or direct. 150 v. $37.50.

Attractive Proposition to Dealers and Jobbers.

LANE MFG. CO., Dept. 11 2941 W. Lake St., CHICAGO

RADIO TUBES
That are Guaranteed

Item	1—Type	200	$2.50
"	2— "	201A	2.75
"	3— "	199	2.75
"	4— "	299	2.75
"	5— "	11	2.75
"	6— "	12	2.75
"	8— "	202	4.00
"	7— "	216	3.00

Mail Orders solicited and promptly attended to.

Agents and Dealers write for Special Discounts

The Arlington Radio Laboratory
214 Beach Street **Arlington, N. J.**

Marle Transformers
The Heart of a Good Receiver
Marle Engineering Co.
Orange **New Jersey**

MAGNAVOX

MAGNAVOX

New Broadcast Receivers combining supreme efficiency, convenience and beauty

HERE at last is the perfected instrument permitting you to enjoy *simultaneously* the most desirable elements of broadcast reception.

Three decisive advantages go with the Magnavox: unequalled simplicity of control, reproduction of exceptional clearness—handsomely carved period cabinets.

TRF-50
(as illustrated)

A 5-tube tuned radio frequency receiver with built-in Magnavox Reproducer unit which consumes no battery. Cabinet measures: height, 14¾ in.; length, 20½ in.; depth, 18¾ in.

Without tubes or batteries . . $150.00

TRF-5

This is identical with the above but encased in smaller cabinet without built-in Reproducer. Cabinet measures: height, 9⅝ in.; length, 20½ in.; depth, 14¾ in.

Without tubes, batteries or reproducer $125.00

Magnavox Radio Receivers, Vacuum Tubes, Reproducers, Power Amplifiers, and Combination Sets are sold by reliable dealers everywhere

THE MAGNAVOX CO., OAKLAND, CALIF.

New York: 350 W. 31st Street *San Francisco:* 274 Brannan Street

Canadian Distributors: Perkins Electric Limited, Toronto, Montreal, Winnipeg

ACCURACY!
PRECISION!

DISTANCE!
SELECTIVITY!

CONTINENTAL
LO LOSS
CONDENSER

13 plate—Cap .00025—$5.50
18 plate—Cap .00035— 5.75

25 plate—Cap .0005—$6.00
45 plate—Cap .001 — 7.00

Without Vernier $1.00 less

A condenser of unusually low dielectric losses, built especially for advanced experimenters and experts who know and appreciate high grade precision instruments.
The Continental Lo Loss never fails to increase the efficiency of any circuit that requires a condenser of pronounced merit.
Special Transmitting Condensers made to your order at reasonable prices.
If your dealer has not yet stocked Continentals write us direct.

GARDINER & HEPBURN, INC.

Philadelphia

Sales Dept—611 Widener Bldg. Factory—2100 Washington Ave.

PEAK Performance on ANY wave length

from 150 to 700 Meters
Regardless of external conditions

'SHEPCO' All Wave Jr.

Trade Mark - Patents Granted and Pending

Non-Radiating DX Coupler

Exclusive "Shepco" bankwound and tapped primary and tapped secondary make the "All Wave" Jr. supremely responsive to ANY wavelength from 150 to 700 meters in triple circuit and from 150 to 1000 meters in single circuit. The ONLY coupler usable in both single and triple circuits. Permits building one tube receiver with multi-tube distance, volume and selectivity. *They're ALL local stations with an "All Wave" Coupler.*

6 efficient hook-ups in each box or sent for ten cents to cover mailing.

At radio dealers or sent prepaid on receipt of price. $6.00

Made and Fully Guaranteed by

SHEPARD-POTTER CO., INC.

Dept. Q. 35 So. River St. Plattsburgh, N. Y.

The Aristocrat of Amplifiers
Quality in Radio is No Less Marked Than Quality in people. The Resistance Coupled Amplifier is a Quality Product.

Daven Complete Amplifier Kit
3-Stage $13.50
4-Stage 17.00
KITS without sockets and condensers.
3-Stage $8.50
4-Stage 11.00
Read "Resistors, Their Practical Application In Radio Reception". By Zeh Bouck. Price 15c. Also read "The How and Why of Resistance Coupled Amplification". Price 10c.

These booklets may be obtained from your dealer.

DAVEN RADIO CORP.
"Resistor Specialists"
Campbell Street, Newark, N. J.

New complete line of radio batteries

AN even better battery and at a much lower cost! That is what you will say when you examine the new Exide "A" battery.

The composition case including handles is moulded in one piece, beautifully stippled and finished in glossy black—an ornament to any room.

Many refinements have been made but you will find the same wonderful Exide plates, the same separators and the same electrical efficiency as the old battery—yet lower in cost!

The Exide two-volt and four-volt "A" batteries for low voltage tubes are midgets in size but giants in power.

New "B" Battery in glass jars

With the increase in popularity of the many-tube sets has come the need for a "B" battery of greater capacity than the twenty-four volt, 4000 milliampere hour, rubber cell Exide used with smaller sets.

To meet this need the new Exide "B" batteries in glass jars were designed. They are made in two sizes—twenty-four and forty-eight volts but with larger plates and greater space for electrolyte, they have a capacity of 6000 milliampere hours.

The new Exide rectifier

With this attractive and compact rectifier, your "B" battery can be recharged from your regular alternating house current, at a cost that is insignificant.

Whatever the size of your set, all of your battery needs can be filled from the complete Exide line. Exide Radio Batteries are sold by Exide Service Stations and Radio Dealers. Ask to see them.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia

In Canada, Exide Batteries of Canada, Limited, 133-157 Dufferin St., Toronto

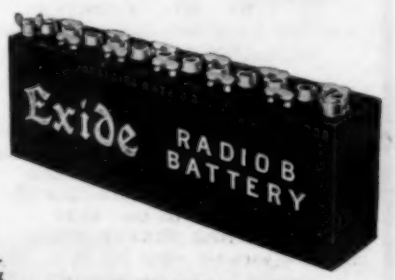
The beautiful new Exide 6-volt "A" battery in one-piece case. Many new refinements but the same old rugged power, $14.60 up f.o.b. Philadelphia.

Exide
RADIO BATTERIES

2-volt "A" battery for low-voltage tubes. Also made in 4-volt size. Prices $5.40 and $7.30, respectively, f. o. b. Philadelphia.

New 24-volt Exide "B" battery in glass jars, 6000 milliampere hours capacity. Also made in 48-volt size. Prices $12.00 and $23.30 respectively, f.o.b. Philadelphia.

New Exide Rectifier. The economical device for recharging your "B" battery from your house current. $2.00 f. o. b. Philadelphia.



Famous Exide "B" battery for smaller sets. 24-volt, 4000 milliampere hours capacity. $10.00 f. o. b. Philadelphia.

For better radio reception, use storage batteries

75 to 220 METERS

The Carter Manufacturing Co.,
1728 Coit Ave.,
E. Cleveland, Ohio.
Dear Sirs:
Am Greatly surprised at the performance of your Ham Special Coupler, it certainly surpassed all my expectations. I hv hrd more Ham DX Stations in 3 nites than I did in 2 years with my old set. It certainly is the cat's meow for DX stuff. Thanks vy much for sending me that circular abt the Coupler that put the idea into my head that I wanted one for it certainly increases the efficiency of a fellow's station 100%.

Very Sincerely,
R. H. Wright, 7PP,
310 Ross Street, Portland, Oregon.

40 METERS

A ten turn coil placed in shunt to secondary coil tunes as low as forty meters see August Q. S. T. 1924 page forty three for detail.

"CARCO" HAM SPECIAL

SHORTWAVE-LOW LOSS COUPLER

DESIGNED BY A HAM FOR HAMS

A compact unit in a space of only 3"x5½".
Antenna Rotor and secondary Stator designed for "Low Loss" and "Low Resistance."
Our special single layer, multiple wound inductance does the trick.
A "Low Loss" Condenser for secondary is the only addition required for a complete tuning unit.
DX work requires a "Low Loss" tuner. Rebuild your set with a 'CARCO" Ham Special. An increase in efficiency will result.

PRICE $8.00 EACH

SPECIAL PRICE TO HAMS ONLY, $5.00

This Special Price is **NET.** *No Discount to Dealers*

Sent C.O.D. A Postal with name, address will bring it.

SET MANUFACTURERS and DEALERS—We specialize on Couplers and inductances. Let us know your needs and we will design the tuner for the desired circuit.
Are you interested in a small variometer, (2" by 3") for crystal sets? We have them.

THE CARTER MANUFACTURING CO.
1728 Coit Ave., East Cleveland, O., U.S.A.

Attention Amateurs

Transmitting material at a sacrifice

The following Meters are manufactured by General Electric Co. They are in original cartons and uniform size.

THERMO COUPLE AMMETERS
0-2.5 amps. or 0-5 amps. List price $20.00
OUR PRICE $7.00

D.C. VOLTMETERS
0-1500 volts. List price $40.00
OUR PRICE $15.00
also 0-500 volts. List price $22.00
OUR PRICE $8.50

D.C. MILLI-AMMETERS
0-250 or 0-500 milli-amps. List price $15.50
OUR PRICE $5.50

OTHER SPECIALS

HOT WIRE AMMETERS
Mnaufactured by Roller-Smith Co., 0-2.5 amps
List price $13.75 OUR PRICE $3.25

D.C. MILLI-AMMETERS
0-150 milli-amps. Manufactured by General Electric Co. $3.25

SPARK TRANSMITTERS
75 watt, portable, made for U. S. Army Aeroplanes. Government cost $45.00
OUR PRICE $5.00

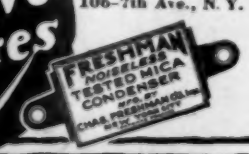
We own and guarantee all merchandise offered

SEND FOR OUR COMPLETE BARGAIN PRICE LIST.

AMERICAN SALES AGENCY
38 Park Row, N. Y. C.

1 No losses through di-electric hysteresis of fiber covers.
2 No insulating binder to melt at the application of heat and by releasing pressure, change the capacity.
3 Capacity fixed and invariable.
4 Metal case protects against accidental injury.
5 Direct connection to copper plates avoids losses through inefficient eyelet contact.
6 Application of soldering iron does not affect condenser.

6 Exclusive Features



All capacities from 35c up. At all dealers

CHAS. FRESHMAN CO.
106-7th Ave., N. Y.

RADIO MASTS

When you buy a Whittlesey Self-Supporting Standard Steel Mast you buy a mast-head pulley, raising cable, and hoisting reel as well. This is the Whittlesey System. Patents pending. Never climb up except for painting, then "use the elevator." These masts are solid, stiff, rigid and beautiful. 50-75-100-125 feet.

THE WHITTLESEY ENGINEERING CO.
Cleveland, Ohio

The GAROD PYREX GLASS Low Loss Tube-Socket

The "Perfect Socket" to complete the Perfect Set!

$1.50

Top View

GAROD engineers, after more than a year's experimentation, research and intensive work, announce the perfection of the ideal tube-socket. In Pyrex glass, they have adapted to use in radio frequency circuits, the finest insulating materials commercially obtainable, and have placed it in one of the weakest spots of the radio circuit: the V. T. socket.

Tests made by the U. S. Bureau of Standards, and the Naval Testing Laboratories, prove "Pyrex" to be the lowest loss insulating material for R. F. C. yet presented, with the exception of quartz. It is strong and heat resisting, and does not absorb moisture. Even the heat of the soldering iron does not affect it. It is entirely free from surface condensation, and is unaffected by those influences which commonly make rubber, rubber derivatives and compounds, porcelain, and the ordinary vitreous products so inefficient.

REPLACE your present sockets with Garod "Pyrex" sockets — or — if you intend building a set — be sure to get Garod "Pyrex". They are solely controlled by the Garod Corporation.

If your dealer cannot supply you — send us $1.50, plus the parcel postage for each socket wanted.

Bottom View

Exclusively a Garod Product

The Powerful GAROD *Neutrodyne* Receiver*

The GAROD Corp.

120 Pacific St. Newark, N. J.

NEUTRODYNE

SIGNAL

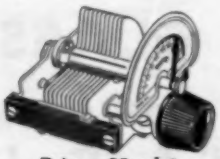
SIGNAL

VERNIER VARIABLE CONDENSER

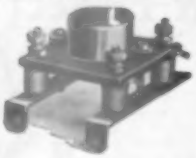
Here is the condenser radio fans have been waiting for. Note these features —'nuff said.

1—Soldered Rotor
2—Pigtail Connection
3—Logging Dial
4—Adjustable Stator Plates
5—Soldered Stator Plates
6—Ample End Spring
7—Unique Clock Hand
8—Main shaft free from dial
9—Cone Bearings
10—Grounded Rotor

Ask your dealer to let you examine this condenser. Write us for illustrated folder giving full particulars.



Prices 23 plate $5.00



SIGNAL TUBE SOCKET

Thousands of these sockets in daily use giving satisfaction. Metal neck with bakelite base.

Extremely Low Loss. The springs are double, phosphor bronze—they spring right back into place when tube is withdrawn. Give your set the best.

SIGNAL Electric Mfg. Co.

Factory and General Offices
1915 BROADWAY,
MENOMINEE, MICH.

Boston Chicago Seattle Minneapolis Montreal New York
Pittsburgh Havana, Cuba St. Louis San Francisco Toronto Philadelphia

You'll find our local address in the Telephone Directory

IT'S A CRIME!

what fellows dont know abt
SHORT WAVES!
AMATEUR RADIO
('HAM' RADIO — Founded 1921 as 'The Modulator')

is chock full of S/W stuff you crave abt. Reinartz S/W dope in September Number. More coming! Original, new, exclusive articles every month. For Special Rate, clip this ad and send dollar bill with address to get A.R. for one year, to →

EXECUTIVE RADIO COUNCIL, 2nd. Dist.
120 Liberty St., New York, N.Y.

2 oz.

from Coast to Coast
from Gulf to Hudson Bay
BRACH
vacuum arresters
have protected
principal Railway Signal Systems, Police and Fire Circuits, and
RADIO
for 18 years

Approved by National Board Fire Underwriters No. 1982

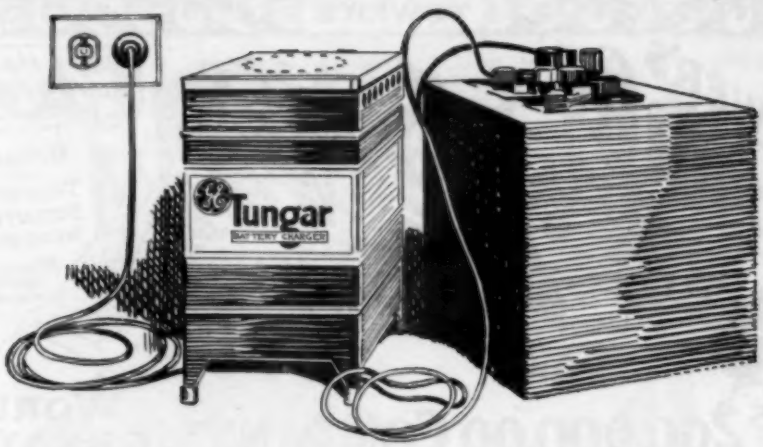
SAFETY *demands the*
BRACH
vacuum radio arrester
L. S. BRACH MFG. CO. NEWARK, N. J.

CRESCENT LAVITE RESISTANCES
Absolutely non-inductive

12,000
48,000
50,000
100,000
Ohms.

LIST $1.50 EACH

Special resistances to order. Used in all circuits.
Dealers write for discount.
CRESCENT RADIO SUPPLY CO.
1-3-5 Liberty St., Jamaica, N. Y.



Partners for Power

For clearness, distance and pleasure from your radio—your storage battery needs its partner—the Tungar Battery Charger.

Tungar keeps the battery at top notch—always ready for you to get every program.

Attach Tungar to the house circuit for overnight charging of radio and auto batteries and be free from care.

Sold by Electrical, Auto-accessory and Radio dealers.

Tungar is one of the many scientific achievements contributed by the G-E Research Laboratories toward the wonderful development of electricity in America.

Tungar Battery Charger operates on Alternating Current. Prices, east of the Rockies (60 cycle Outfits)—2 ampere complete, $18.00; 5 ampere complete, $28.00. Special attachment for charging 12 or 24 cell "B" Storage Battery $3.00. Special attachment for charging 2 or 4 volt "A" Storage Battery $1.25. Both attachments fit either Tungar.

Tungar
REG. U.S. PAT. OFF.
BATTERY CHARGER

Tungar—a registered trade mark—is found only on the genuine. Look for it on the name plate.

Merchandise Department
General Electric Company
Bridgeport, Connecticut

GENERAL ELECTRIC

482-11

TOWER'S

TOWER'S Scientific

WEIGHS ONLY 8 OZ

Perfect Tone Mates

$2.95 Plus a few cents postage

OUR $200,000.00 COMPANY STANDS SQUARELY BACK OF EVERY HEADSET

WORLD'S GREATEST HEADSET VALUE

now $2.95, with Notable Improvements

Longer Cord (full 5 feet), Stronger Magnets, Higher Resistance, Increase of Sensitivity, Perfect Tone Mates

EVERY SET TESTED BY LICENSED RADIO OPERATORS

Send no money - Order on a Post-Card

THE TOWER MFG. CO. : 98 G BROOKLINE AVENUE, BOSTON, MASS.

Scientific

Break-In Relays

FOR SHIPBOARD

Model 18 Type S 1, 6 volt

$23.00

Model 18 Type S 2, 120 volt

$25.00

FOR THE AMATEUR TUBE TRANSMITTER

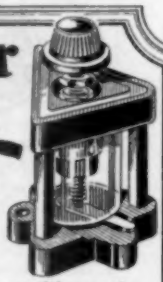
Model 24 Type S 1, 6 volt

$16.50

LEACH RELAY CO.

507 Mission St., San Francisco

Best for Reflex



and Crystal Sets

FRESHMAN

Double Adjustable Crystal Detector

No more searching for the sensitive spot. --Merely turn the knob as you would a dial.

For base or panel mounting, complete with Freshman Super - Crystal **$1.50**

At your dealer's, otherwise send purchase price and you will be supplied postpaid.

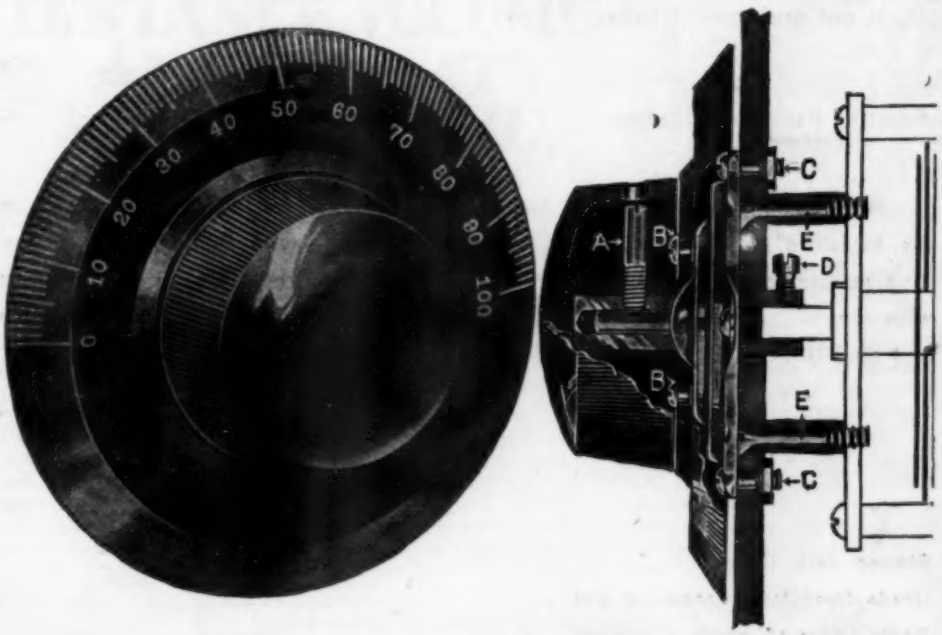
CHAS. FRESHMAN CO., Inc.
106-7th Avenue, New York

"WARRANTED"
Audio Transformer
MTD. $2.00, UNMTD. $1.45
10 Days Money Back Guarantee
Dealers Write

C. C. ENDLY
22 Sturges Ave.
MANSFIELD, O.

NATIONAL VELVET VERNIER DIAL

Simplifies Selectivity



For Condensers, Variometers, Variocouplers, etc.

The mechanism of the National Velvet Vernier Dial is made entirely of bronze or brass and has an exceedingly long life. There is nothing to wear out. There is no lost motion or "back-lash" and none develops with use. It possesses what has been termed by a leading radio engineer—

"That velvet touch which delights the heart of the radio constructor"

The large dial is of black bakelite, highly polished, with perfectly uniform graduations. The knob is also of bakelite and is of ample size, The parts run true and uniform and the graceful lines form a combination that is very pleasing.

Price complete 2″ Bakelite Knob 4″ Bakelite Dial $2.50
Price complete 2″ Bakelite Knob 3″ Metal Dial 2.00

Manufactured by

NATIONAL COMPANY, INC.

110 Brookline Street, Cambridge, Mass.

To Our Readers Who Are Not A.R.R.L. Members

Wouldn't you like to become a member of the American Radio Relay League? We need you in this big organization of radio amateurs, the only amateur association that does things. From your reading of *QST* you have gained a knowledge of the nature of the League and what it does, and you have read its purposes as set forth on page 6 of every issue. We would like to have you become a full-fledged member and add your strength to ours in the things we are undertaking for Amateur Radio, and incidentally you will have the membership edition of *QST* delivered at your door each month. A convenient application form is printed below—clip it out and mail it today.

.....1924

American Radio Relay League,
Hartford, Conn.

Being genuinely interested in Amateur Radio, I hereby apply for membership in the American Radio Relay League, and enclose $2 in payment of one year's dues. This entitles me to receive *QST* for the same period. Please begin my subscription with the.....issue. Mail my Certificate of Membership and send *QST* to the following name and address.

.....

.....

.....

Station call, if any.....

Grade Operator's license, if any.....

Radio Clubs of which a member.....

Do you know a friend who is also interested in Amateur Radio, whose name you might give us so we may write him about the League?.....

.....Thanks.

A "HE" EMBLEM FOR LEAGUE MEMBERS !

To cover that bare spot on your shack wall, we offer a large A. R. R. L. Shield of reinforced papier-maché, black and gold, 18x9 inches, with brass ring for easy hanging. And it's just the thing for A. R. R. L. Convention decorations, ham booths at Radio Shows—in fact, everywhere that good A. R. R. L. men get together.

It's only $1.25 postpaid.

American Radio Relay League **Hartford, Conn.**

ALL-AMERICAN

now brings you

DISTANCE, VOLUME AND QUALITY with *ONE TUBE*

Self-Tuned Radio Frequency Transformers —Wound to Suit the Tube

OUT of a year of many experiments and numerous failures to achieve in a practical instrument the theoretical possibilities of broad-tuned Radio Frequency Amplifiers, has come a simple but far-reaching discovery. Radio Frequency Transformers can and must be *adapted to the characteristics of the particular vacuum tube* whose grid voltage they supply. That truth—with All-American scientific research and All-American precision manufacturing—has made radio history

SELF-TUNED RADIO FREQUENCY TRANSFORMERS *have arrived*—and All-American, naturally enough, has brought them. Never before has an instrument been built which will amplify so effectively, over the entire radiocast range, as will the new All-American Types R-199 and R-201A. Together with the new Type R-140 All-American Universal Coupler, they have made possible a *new standard of efficiency* in Radio Frequency and Reflex receivers.

As an example of this, we offer ALL-AMAX JUNIOR (1 Tube) and ALL-AMAX SENIOR (3 Tube). Both are *All-American-coupled throughout*, and both exemplify the new standard of performance.

Build an ALL-AMAX—using the complete panel scheme and wiring plan shown in your KEY BOOK—and you will never go back to an ordinary reflex set. Distance and power are yours!

All-Americans—Precision-Made for Reliability

Sold by all the Better Dealers

Audio Frequency Transformers
"All-Americans for Reliability"

Ratio 3 to 1	R-12.	$4.50
Ratio 5 to 1	R-21.	4.75
Ratio 10 to 1	R-13.	4.75

Built by Precision Methods in a Modern Plant, All-Americans Audios are Unsurpassed at any price for Quality Reproduction and Dependable Service

Long Wave Transformer
For High Amplification and no distortion of side bands at 4,000 to 20,000 meters (75 to 15 Kilocycles) R-110, $6.00

Power Transformers
For Tone Quality in a Third Stage, or for Loud Volume with Clearness.

Input Type	R-30,	$6.00
Output Type	R-31,	6.00

An absolutely new kind of book —immensely valuable to both beginner and expert.

ALL-AMAX JUNIOR *and* SENIOR; *also many other good hook-ups.*

Send for 10 *cents, coin or stamps.*

RAULAND MFG. CO.
2642 Coyne St.
CHICAGO
Pioneers in the Industry

Radio Frequency Transformers
"Self-Tuned—Suited to the Tube"
Effectively amplifying all Frequencies with the Radiocast Range.
For "199" Tubes R-199, $5.00
For "201A" Tubes R-201A, 5.00

10,000 Meter Transformer
It gives superior results in best reception, filtering out a .30 Kilocycle Frequency with high selectivity and no side-band distortion. R-120 . . $6.00

Radio Frequency Coupler
(Oscillator Coupler.) A uniform output at 150 to 650 meters. R-130 . . . . $5.00

Universal Coupler
Sets a new standard of efficiency as an antenna coupler, as a radio frequency transformer in tuned stages it is unsurpassed. R-140 . $4.00

ALL-AMERICAN
TRADE MARK

Largest Selling Transformers in the World

"Rolls Royce" Radio Tubes

Like their name significant of QUALITY. A powerful and durable tube that will greatly improve reception. Increases range and volume with a maximum of clearness. Our direct sales plan enables you to buy "Rolls Royce" at the lowest possible price.

Type 200.....5 volts, 1 Ampere Detector Tube
Type 201A.....5 volts, .25 Ampere Amplifier and Detector
Type 199.....3-4 Volts, .06 Ampere Amplifier and Detector
Type 199A.....3-4 Volts, .06 Ampere with Standard Base Amplifier and Detector
Type 12 .....1½ Volts, .25 Ampere Platinum Filament Amplifier and Detector.

"The Rolls Royce of Radio Tubes" ALL TYPES **$2.50**

Type 202.....5 Watt, Transmitters, $3.00

EVERY TUBE GUARANTEED

to work in Radio Frequency, especially adapted for Neutrodyne, Reflex and Super-Heterodyne Sets.

Shipped parcel post, C.O.D. When ordering mention type.

ROLLS ROYCE TUBE CO.,
21 Norwood St., Dept. S. Newark, N. J.

DUPLEX

PATS. PEND.

Series "FR" Condenser

Designed to ground rotor to frame.

Mechanically and electrically perfect.

We have reduced the electrical losses to an immeasurable minimum.

Some profitable jobber territory still open.

Write for Bulletin "Facts for Fans" on Condensers

TRADE MARK
NONE OTHER

The Duplex Engine Governor Co., Inc.
50 Flatbush Ave. Extension
Brooklyn, N. Y.

Na-ald DeLuxe
No. 400 75c

"It's the contact that counts"

Na-ald DeLuxe Socket, combining the highest insulating qualities and perfect contact. Rotate your tube several times. Instantly the duo-contact removes corrosion, making a bright perfect connection.

End your socket troubles with Na-ald.

Send for literature

Alden Manufacturing Co.,
Dept. M, Springfield, Mass.

NA-ALD

EBY +

There is only one
GENUINE
EBY Binding Post

"With tops which Don't Come Off"

Eby Posts are scientifically designed, beautifully finished and their price is right.

This is our Ensign post which can be furnished either plain or engraved in twenty-five different markings.

EBYS Are Binding Posts PLUS
H. H. EBY MFG. CO. Phila., Pa.

OHIO BRASS CO.
ANTENNA INSULATORS

Distributed by

H. N. UMBARGER
65 N. Diamond St., Mansfield, Ohio.

FREE

YOUR OWN Name, Address and Station Printed FREE on CALL CARDS & RADIOGRAMS

ARRL Emblem added if requested

Cards: Red call, black printing. High quality, latest design. 100-$1.75; 200-$2.75; 500—$3.50. POSTPAID.
Radiograms: Bond paper. 100-$1.25; 200-$1.85; 500-$2.85. POSTPAID.

MONEY REFUNDED if Not Delighted

Write for INDIVIDUAL Radio Stationery and leg samples and prices.
Send order with check or money order Today—NOW.
RADIO PRINTERS, 17 Main St., Mendota, Illinois

Make the World of Music Yours

WHEN a famous soprano sings the Gipsy Song from Carmen, hear it in your home exactly as she sings it.

Through Music Master, the musical instrument of radio, let her voice be crystal clear. Music Master gives to radio life and beauty, lending a wholly new charm to the wonders of the air.

Music Master is not just a loud speaker—it is a *true* speaker, a *clear* speaker, a pleasing musical instrument.

Radio impulses entering the sensitive precision instrument in the base are translated into sound waves, undistorted and faithful to the original voice or instrument. In the tapered tone chamber of cast aluminum these sound waves grow clear and bell-like and, finally, the full, mature tones pour forth in rich resonance through the Music Master amplifying bell of natural wood.

Your dealer knows. Have him send you a Music Master to be proved with your own set.

Dealers Everywhere

Music Master Corporation

Makers and Distributors of High Grade Radio Apparatus

10th and Cherry Street

Chicago PHILADELPHIA *Pittsburgh*

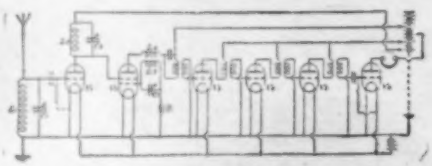
Music Master

RADIO REPRODUCER

Connect Music Master in place of headphones. No batteries required. No adjustment.

14-inch Model, for the Home $30

21-inch Model, for Concerts and Dancing $35

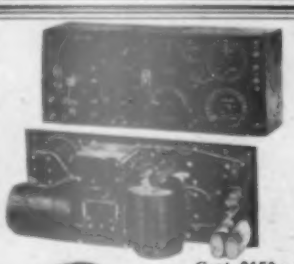


GREATER RESULTS THAN EVER!

—Send for this diagram.
The Nutron Solodyne (double-grid) Tube acts as both oscillator and modulator in the Super-Heterodyne Circuit, thereby not only eliminating one of the tubes but obtaining greater efficiency as well. In Reflex Sets the Nutron Solodyne (double-grid) Tube can be used as both detector and amplifier (dual amplification) thereby doing away entirely with the crystal or detector tube. The Nutron Solodyne (double-grid) Tube made possible the No "B" Battery (Solodyne) Circuit. Thousands are now enjoying this smooth reception and its rapid gain in popularity is ample proof of its unusual qualities.
Send at once for Nutron Solodyne (double-grid) Tube and diagram illustrated above or for Tube and diagram of 2-tube reflex, or for Tube and No. "B" Battery hook-ups. See them for yourself. If your dealer does not yet carry these tubes, order direct from us. Always look for No "B" Battery hook-ups. See them for your-assurance of tube perfection. Each Nutron Tube is rigidly tested and guaranteed. Price $6.00.
The long distance record for a one tube set, made by J. L. Leistra recently, was accomplished with a double-grid tube.

NUTRON
Silben Spot

NUTRON MANUFACTURING COMPANY
729 Main Avenue, Passaic, New Jersey



NAVY CN 113

Receiving Set 300-2,500 M. Tunes DX Broadcast, Ships and Arcs. Terminals for Attachment of Audion. Crystal detector on panel. Size (7x17x5" Deep.)

Cost $150; Price $21.50

0-150 Milliamps Improve your Transmitter and "super" 2¼" Dia. $2.75
Post Paid on all

GEORGE EATON
1915 South Twelfth
Philadelphia, Pa.

A high resistance crystal is best for Reflex Sets. B-METAL resistance very high. Your dealer will order it.
B-Metal Refining Co
525 Woodward Ave
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General Electric Generators

Double Current

May Be Used as Dynamotors for C.W. Transmission

Driving Voltage	Plate Voltage	Mills
12	550	130

Made for the United States Army Air Service. Equipped with a Dubilier Filter System. Using 2¼ MF. 1800 volts Mica Condensers. Ball Bearings Equipped. All new, in original cases. Price

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Half Cash With Order—Remit by Money Order to Facilitate Immediate Shipment

We also have: CW-936 Sub Chaser Telephone Transmitting and Receiving Sets including:—Remote Control System, Power Amplifier, Loud Speakers, Tubes, Spare Microphone, etc. Can be tuned down to 150 meters. Absolutely new sets.

Navy Long Wave Tuners Type CN-240, Tuning Range 1000-30000 meters. You will want one for long wave reception—SPECIAL PRICE $75.

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Zenith Sets (Regenerative)
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Audio Frequency

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TRANSFORMER
A Lap Ahead of the Field

About the size of an English Walnut. Saves space; light weight; mounts anywhere; unsurpassed in performance. Ratios 1 to 3, 1 to 4, 1 to 5, $3.50. 1 to 10, $4.50. Ask your dealer to show you the Premier line of quality Radio Parts. Send for Free Bulletin 394 today!

Premier Electric Company
3811 Ravenswood Ave. Chicago.

A Radio-Frequency Ammeter

is essential with Transmitting Apparatus

This ammeter, in your transmitting circuit, will tell the strength of the current in the antenna which, in turn, is an indication of the effectiveness and character of the transmission.

Westinghouse Radio-Frequency Ammeters are available in four styles, the BX is the smallest, 2-9/16 inches in diameter, and is an attractive addition to any panel. The CX is a larger instrument, 3-1/2 inches in diameter, suitable for larger panels. Instruments 4-3/8 inches and 7-1/2 inches in diameter may also be obtained.

Precision workmanship of the finest materials, combined with years of experience in the design of electrical measuring instruments, have made possible these small yet accurate, sturdy and reliable radio instruments.

Westinghouse & Electric Manufacturing Company
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Sales Offices in All Principal Cities of the United States and Foreign Countries

Westinghouse

CARDWELL

The Original Low Loss, Rotor Grounded Condenser

"Play safe—Say Cardwell"

Using Cardwell rotor-grounded condensers will often add a thousand miles to your receiving range. They have such infinitesimal losses at the highest radio frequencies that no one has been able to determine their effective resistance. It is doubtful if engineers can design condensers of greater efficiency. Interference and "body capacity" are unknown with Cardwells.

A Post Card Brings You an Education on Condensers

Allen D. Cardwell Mfg. Corp.
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Don't Guess

Get a *real* voltmeter—the *Roller-Smith Radio PV*.

With it you can quickly *and accurately* test all radio A, B and C batteries and make any other tests.

Its price is reasonable and it will save its cost many times over.

Send for Bulletin AG-40.

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Works: Bethlehem, Penna.
Offices in principal Cities in U.S.A. and Canada also in Havana, Cuba.

Price $8.50

Duo-Spiral *Folding Loop*

Now the standard loop for the super-heterodyne.
Has concealed hinge, and swivel base graduated for calibration.
Handle permits adjustment without body capacity effects.
Fine silver and mahogany finish.
Made by the manufacturers of TINY-TURN the superior vernier control. Write us direct, if your dealer is unable to supply you.

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We Repair All Standard Makes of Tubes, Including

W.D. 11 or 12
U.V. 199 or C299
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C. 300 or 301 U. V. 202 Repaired. $3.50

$2.00

All tubes guaranteed to do the work.
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All Mail Orders Given Prompt Attention
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FOR MEN ONLY

who have ideas.

You may not have a machine equipment to manufacture. We have. We engrave your panels, build your set, produce your special coupler, transformer, condenser or loop and mark it with your own name and trade mark.

Mail specifications today for quotation.

WRIGHT RADIO COMPANY
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Ask for Lit. On the Wright LO-LOS LOOP

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Ask Your Neighbor

THE name **FROST-RADIO** on a piece of apparatus, whether **FROST-FONES**, Plugs, Jacks, Sockets, Rheostats, etc., means highest quality. Your dealer carries complete stocks. See him today.

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HAM-ADS

Six cents per word per insertion in advance. Name and address must be counted. Each initial counts as one word. Copy must be month's issue. NOTE NEW CLOSING DATE.

SNAPPY WEATHER BRINGS SNAPPY SIGS, BUT DON'T CHOKE EM OFF. A HIGH RESISTANCE IS FB IN A GRID LEAK BUT NOT IN A B BATTERY. WHAT'S THE ANSWER? AN EDISON B (THE 8ML KIND). 54 VOLTS 42 CELL $8.75 (JUST RIGHT FOR THE RELAY STATION). 100 VOLTS 78 CELLS $16.00 (MOST POPULAR SIZE). 130 VOLT 102 CELL $20.00. 150 VOLT 117 CELL $23.00. EACH IN A WAX FINISHED FUMED OAK COVERED CABINET WITH RIBBED RUBBER MAT. LARGEST LIVE EDISON ELEMENTS WIRED WITH PURE SOLID NICKEL NOT PLATED OR ALLOY WIRE, THE SOLUTION IS GENUINE EDISON LITHIUM ELECTROLYTE (THAT'S NO LYE), SEPARATORS NON-FLOATING PERFORATED HARD RUBBER, WHITE SEALING OIL, CAREFULLY PACKED FOR SAFE SHIPMENT. INDIVIDUAL CELLS 16c. BUILD YOUR B FROM 8ML PARTS AND INSURE ITS SUCCESS. LARGEST CLEAN PEPPY TYPE A EDISON ELEMENTS 6c PAIR, DRILLED 7c, WIRED WITH PURE SOLID SOFT NICKEL 10c. DOUBLE 2000 MILIAMP HOUR UNIT 14c READY TO WIRE. EDISON G ELEMENTS 4c PAIR, 2 POSITIVES 1 NEGATIVE 5c, HICAPACITY 1500 MILIAMP HOUR UNIT DRILLED READY TO WIRE 10c. PARTS FOR CELL 17c; WITH ELEMENTS DRILLED AND CUT IN UNITS 19c, WITH CELLS WIRED 24c. INCLUDES EDISON SOLUTION. GREAT FOR SUPERS, POWER AMPLIFIERS, TRANSMITTERS. FOR THAT SUPER-HET AND HIPOWER TRANSMITTERS, THE SUPER-CELL, 3000 MILIAMPS CAPACITY. 30c CELL FOR SOLUTION AND ALL PARTS READY TO WIRE. DON'T STARVE YOUR STORAGE B. FEED IT WITH A WILLARD COLLOID RECTIFIER $2. JUMBO SIZE $3. ANNEALED GLASS TEST TUBES INDIVIDUALLY WRAPPED, ¾x6" 3c, 1x6" 4c. WIRE YOUR EDISON ELEMENTS PERMANENTLY WITH PURE SOLID (NOT PLATED OR ALLOY) NICKEL WIRE, No. 20, 1½c FOOT PREPAID. PERFORATED HARD RUBBER SEPARATORS ½c PREPAID. PUTS LIFE IN A DULL B, INSURES THEIR FULL CAPACITY—EDISON LITHIUM (THAT'S NO LYE) ELECTROLYTE $1.50 TO MAKE 5 LBS. PREPAID. SAMPLES—TYPE A, OR G HICAP CELLS 25c, SUPER-CELL 40c. EVERYTHING FOR THAT EDISON B. WHO SAID QUIET HOURS? NOT IF YOU HAVE AN EDISON B ON THAT SHORT WAVE TRANSMITTER. FRANK MURPHY, RADIO 8ML, 4837 ROCKWOOD ROAD, CLEVELAND, OHIO.

HUSTLE, GANG AND GET UP THAT NEW AERIAL. THOSE NEW SHORT WAVES MEAN MORE PRONOUNCED LOSSES WHEN THEY MEET MOULDED MUD AND STRANDED 22. FOR A QUICK GET-AWAY No. 12 ENAMELED SOLID COPPER AERIAL WIRE, SURE PUTS A ZIP IN THOSE SIGS. 1c FT. TO 3RD ZONE. GENUINE OHIO BRASS CO. PORCELAINS HAVE LOWEST LOSSES OF ANY INSULATOR—QST SAYS SO. 5" 75c, 10" $1.50 FLUX DISTRIBUTING SHIELDS ADDED $1.00. PREPAID TO 3RD ZONE. YOUR STATION IS JUDGED BY ITS AERIAL. MAKE EM LOOK TWICE. SILICON STEEL PUNCHINGS FOR THAT CHOKE (SHORT WAVES CALL FOR PURE DC) 20c lb. 2½ x10". WE'RE ALL MAKING LOW LOSS TUNERS NOW, GET THE MAKINGS FROM 8ML. No. 12 PURE COPPER DOUBLE COTTON COVERED FOR LOW DISTRIBUTED CAPACITY $1.25 100 FEET, PREPAID. No. 16 LOW LOSS TUNER WIRE SIXTY CENTS HUNDRED FEET PREPAID. RADIO 8ML, 4837. ROCKWOOD ROAD, CLEVELAND, O.

JEWELL 0-500 MILLIAMMETER $6.00; "S" TUBES PAIR $20. HESCO KEY $2.00; VIBROPLEX $8.50 UV-203 50-WATTER $15.00. WANT OMNIGRAPH. JAMES R. CURTIS, 1109 EIGHTH AVENUE, FORT WORTH, TEXAS.

PSE TYPEWRITE UR HAM-ADS, OM, IF U CAN. IT HELPS A LOT.—ADV. MGR.

HIP, HIP, HOORAY—PERMISSION TO USE THE REAL LOW WAVE LENGTHS IS URS FOR THE ASKING. GOTTA USE A REAL CONDENSER THO BROTHER, THE MUD END-PLATE TYPE JUST WON'T PRODUCE. GOTTA HAVE SOME GOOD TYPE OF INDUCTANCE TOO, AND HERE'S THE LOW-DOWN ON THE DOWN LOW PARTS. CARDWELL .00025 ORIGINAL LO-LOSS, $4.25; CARDWELL .0005 ORIGINAL LO-LOSS $5.00; GENERAL RADIO GEARED TYPE .00025 $4.75; CARDWELL RADIO GEARED TYPE .0005 $5.00; No. 12 DCC MAGNET WIRE per lb. 60c; No. 15 DCC MAGNET WIRE per lb. 65c; No. 18 BELL WIRE ½ lb. SPOOLS 35c; UNIVERNIER FOR CARDWELLS, $1.25. SA OM, HOW ABOUT THAT RECTIFIER? IS SHE IN TIP TOP SHAPE? READY FOR SNAPPY ACTION? IF NOT, BETTER GET SOME OF THE BELOW ITEMS AND BE READY FOR THE FRAY. C. P. SHEET ALUMINUM SQ. FT. 90c; SHEET LEAD SQ. FT. 75c; AMRAD S TUBES, NEW TYPE $10.00; MOGUL BASES FOR ABOVE 85c. A POST CARD WILL BRING PRICE LIST BY RETURN MAIL, FROM THE ONLY HAM STORE IN THE FIFTH DISTRICT. FT. WORTH RADIO SUPPLY CO., 104 EAST TENTH FT. WORTH, TEXAS.

QSL CARDS—Real "Ham" Cards at reasonable prices. Send for samples, 8BJT, 701 Walnut Ave., Scottdale, Pa.

FOR SALE—Duplicate of Exp. Information Service Model C Super Heterodyne 8 Tube. Completely assembled in cherry cabinet. Panel 8x40 inches wired slightly different but have had perfect reception entire US on loud speaker and British 2LO. Future position will have no need for it. Price less tubes, batteries, etc., $175.00 C.O.D. F. Henry, 211 Norwood Avenue, Buffalo, N. Y.

HAMS LOOK!—Transmitting Condensers, U. C. 1831, $3.85. Magnavox Horns—factory cartons, M4, $18.75, M1, $21.75, R3, $23.75. Radio Corporation and Cunningham receiving tubes, all types, $3.75. 2500 ohm phones, $1.98. Westinghouse receiving tubes, $1.78 each. Eveready 766, 22½ volts, $1.55. Audio Transformers, U. V. 712, Acme, Federal, Thordarson, $1.95 Radio Corporation Hot Wire Ammeters, $1.95 each. Ernie Albright, Radio 8DRA, Altoona, Pa.

TWO ABSOLUTELY NEW Amrad S tubes improved type $8.00 each; Jewell Antenna Ammeter 0-5, $7.50; UV202, $5.00; 2 Radiocorp receiving condensers $1.00 each; Transmitting grid leak $1.00; Transmitting key 75c; Microphone, 50c; Old style Jewell antenna ammeter 0-2½, $7.50. Louis Grabensteder, 2653 Dennis St., Cincinnati, Ohio.

METERS—METERS—METERS—Brand new Radio Corp meters, in original boxes. UM 579, 0-1500 volts DC, $10.00; UM 578, 0-500 volts DC, $8.50; UM 576, 0-500 milamps. DC, $6.00; UM 575, 0-250 milamps. DC, $5.00; UM 581, 0-5 thermoamps., $6.00; UM 580, 0-2.5 thermoamps, $5.00, UM 533, 0-5 hotwire amps., $2.00; UM 530, 0-2.5 hotwire amps., $1.50. W. M. Derrick, 58 North Sixth, Newark, N. J.

LO-LOSS Tuners and Coils. 8BIN.

SWAP or SELL—UV-200; 30-Ohm Rheo; Loud-Speaker; Broadcast Set. WANTED—Bradley-Leak, Filter Condensers. 9BTY.

BARGAIN—1K.W. Plate transformer rewound Acme—500—1700 volts in steps of 100 volts either side of center tap—weight 50 lbs.—$20. 0-250 General Radio Milliameter—$4. C. W. Park, Box 237, Riverbank, Calif.

SELL—Thordarson 1 K.W. transformer, $15.00; also two V.T.2's @ $7.50 each. First money talks. Wm. Dudley, 114 Road St., Elizabeth City, N. C.

COMPLETE CW AND FONE Station For Sale—Everything goes in one lot, plate supply, transmitter, key, switches, microphone, receiver with power amplifier and W.E. loudspeaker, batteries, tubes and charger.. Here is the chance to buy a station complete, one that is working. . This is no junk but good factory built receiver and standard part transmitter. No trades. Will invoice around $500.00, will correspond with party who will consider paying half price for whole outfit. Walter E. Smith, Grayville, Ill.

GET UR NOVEMBER "HAM-ADS" TO QST, BEFORE OCTOBER FIRST—OR WE WON'T BE ABLE TO INSERT.—ADV. MGR.

8 A-Q-C PRINTS Q-S-L CARDS, 500 TWO COLOR CARDS $4.00. SAMPLES ALL DISTRICTS 10 CENTS. CURTIS, 1109-B EIGHTH AVENUE, FORT WORTH, TEXAS.

LISTEN, O.M. Get down on the lower waves. Our special low wave receiver will settle your receiver problem and we can help you to solve that transmitter problem for short waves. Two control dial short wave receiver with two stage amplifier, $45.00 P.P. Other prices on request. Coils for receiving and transmitting. Low loss type. Get our dope. Special equipment made to your specifications. Speech amplifiers. C.W. Inductances for four coil Meissner circuit. Chokes that choke. Amateur equipment at amateur prices. To the first one in the mail one $100 Neutrodyne $50 Gold engraved panel and dials matched. Write Thos. Ensall (Ensall Radio Lab.) 1208 Grandview Ave., Warren, Ohio.

GAROD RAF Neut. New. $85. Federal 59, new $165. Federal DX58 Used 1 mo. Perfect condition $80. 3 tube regen in oak cab. 18x8 high for WD-11's used, good condition $45. 3 tube Inverse-Duplex (Grimes) for loop, fumed oak cabinet 12x8 high New $69. 1 tube regen in cabinet with new WD-11 used but motes fine, Good DX $32. W. M. Mervine, 608 Parry Ave., Palmyra, N. J.

OHIO BRASS INSULATORS, 5" and 10", 8BIN.

SALE—Old 3QF spark transmitter, copied in 27 states and Canada—minus gap motor—$20.00. Pre-war type E Baldwins, cost $19.00. Unequalled today, sell $8.00; type CR-3A Grebe tuner—$12.00; Richard Hammond, Ardmore, Pa.

WESTINGHOUSE MOTOR GENERATOR—500 volts 100 watts cost $85.00 sell $55.00 one Fifty watter. Hardly used $18.00. 9CKJ, Russell, Kansas.

3 CIRCUIT in cabinet, looks like Grebe. Have worked 6's with it. Make offer. Homcharger $8.00. Both in good condition. 8WY.

PURE DC HOUNDS, use Radio Corp parts at these prices. New stuff in original packing. UP 1626 25 henry 160 milamp. choke, $6.50; UP 1653 30 henry 160 milamp. choke $7.00; UP 1627 40 henry 300 milamp. choke, $8.00; UP 1654 50 henry 300 milamp. choke, $9.00; UC 487 ½ mfd. 750 volt filter condenser, 75c; UC 489 ½ mfd. 1750 volt filter cond. $1; UC 1873 choke trap condenser .01 mfd. $1. W. M. Derrick, 58 North Sixth, Newark, N. J.

8SP OFFERS EIGHT twenty-watt Kenotron rectifiers, only slightly used, sacrifice $4 each. Big bargain for somebody!

WANTED—All types and parts of CW and receiving sets. Motor-generators, transformers, meters, also whole receiving and transmitting sets. Let me know what you have and lowest prices. Bill Lippman, Jr., 6 Thornby Place, St. Louis, Mo.

RADIO PRINTING FOR HAMS. 8BIN.

FOR SALE CHEAP—Every description of CW and receiving apparatus, sync rectifier, transformers, Motor Generators, Jewell Meters, etc., also several complete receiving and CW transmitting sets. Send me your needs. 9CVO.

TRANSMITTING AMATEURS Attention—Don't leave those costly tubes and meters lying around to be broken. Mount your transmitter on panel. Looks better, works better. QST says so. It's easy to cut those peep and meter holes with my panel tool. Cuts smooth hole one to five inches in diameter; only $2.50 postpaid or C.O.D. Homer H. Malcomb, Whitewater, Wisc. 9EKH.

SPOKEN ESPERANTO for Beginners—Lead, don't follow, the crowd! The language of worldwide radio is taught directly, correctly, and quickly by this up-to-date manual for teachers and classes. 92 pages, illustrated. Send $1.00 for 2 copies paper-bound or 1 clothbound. N. W. Frost, 12 Ash Pl., Cambridge 38, Mass.

FOR SALE—AR Unit three stages of Radio Frequency to be used with Westinghouse R.C. sets, this gives the RC sets range and volume, reception from coast to coast. This has been used less than one week, in perfect condition. Reason for selling have no use for it now. Can be used with others than RC sets. This is RCA product, Price $30.00. W. S. Neely, Chester, S. C.

RADIO 3CHG WRITES—UR C.P. ALUMINUM IS SURE BEST I EVER USED. REPORTED ALL DISTRICTS ON 10 WATTS TT QSB WAS PURE DC. "FB, EH"? ORDER SOME AND GET SOME REPORTS LIKE ABOVE. ALUMINUM SQUARE FOOT PRICE 90c SHEET LEAD 75c. FORT FORTH RADIO SUPPLY CO., 104 EAST 10th., FT. WORTH, TEXAS.

158 GENUINE Foreign Stamps. Mexico War Issues. Venezuela, Salvador and India Service Guatemala, China, etc. only 5c. Finest approval sheets 50 to 60%. Agents Wanted. Big 72p. Lists Free. We Buy Stamps. Established 20 years. Hussman Stamps Co., Dept. 151, St. Louis, Mo.

BARGAINS IN RECEIVING APPARATUS—Write for special price list of radio parts which we are closing out. List includes variometers, couplers, honeycomb coils, and mountings, sockets, rheostats, etc. Address Radio Dept., John Y. Parke Co., 31 N. Seventh St., Philadelphia, Penna.

IS YOUR NEUT RIGHT?—To revitalize unneutralizable Neutrodynes, we devised this Kladag Coast to Coast Circuit. Uses same panel, etc. as Neut, except three less parts. Merely rewire. Success certain. Necessary stabilizer, 22 feet gold sheathed wire, circuit and complete, simple instructions, $5.00 prepaid. Many have already rebuilt their Neuts-and written wonderful testimonials. Thousands will do it. Be FIRST-have the finest five tube set in your neighborhood, revitalize others' Neuts. Description, etc., 10c. Radio Lists, 2c. Stamps accepted. Kladag Laboratories, Kent, Ohio.

RADIO GENERATORS—500 volt 100 watt $28.50 Battery Charging Generators $8.50. High Speed Motors Motor Generator Sets, all sizes. Motor Specialties Co., Crafton, Penna.

WESTINGHOUSE DYNAMOTORS. 12 Volt D. C. motor, 350 volt D. C. Generator. New, $10. Box H, QST.

WAVEMETERS CALIBRATED from General Radio Precision Standard, 30 meters up. Eleven points $2.00. Twenty-one points $3.00. Accuracy guaranteed to better than 1%.—With curve 50c and 75c extra. Capacity Calibrations, up to 2000 micromicrofarads same prices. Ship to 9ZA—9CD, ex 9XBA, F. J. Marco, 5723 Winthrop Avenue, Chicago.

PUREST VIRGIN Aluminum for sale. Particulars upon request. 2EM.

SELL—General Electric 500 volt 100 watt, 110 volt 60 cycle. Motor Generator, $38. Guaranteed. Laager, 113 Pawtuxet Ave., Cranston, R. I.

FOR SALE—600 watt Thordarson transformer $10; 0-10 Weston thermocouple ammeter $7; 500 volt 125 watt motor-generator $25. Marion Graham, Angola, Indiana.

FOR SALE—Ten watt transmitter, complete with tubes, filter system and G.E. generator. Used only five weeks and in A1 condition. Photo on request. W. A. Roben, Ashton, Iowa.

THREE CIRCUIT Receiver and 3 Step, $40.00; 2 Stages Tuned Radio Frequency, attachment, $10.00. Single Circuit and 1 step, with dry cell tubes, $15.00. Description on request. Geo. Lay, Golden, Colo.

RCA TRANSMITTING PARTS. 8BIN.

MAGNETIC MODULATOR 1367—$10.00 Complete chopper—$6.00. Acme Modulation Transformer $4.00. Federal Amplifying transformers $4.00. Back numbers to 1915 Electrical Experimenter, Everyday Engineering, Radio News, QST, 20c each. 2AIF.

ACME POWER TRANSFORMER—Want 200 watt mounted type in serviceable condition. George Cowie, Norfolk, Connecticut.

9AEC DISMANTLED. All apparatus must be sold. Sacrifice prices. Write for list.

FOR SALE—Advance Sync. Rectifier $30.00; 800 watt 2000 volt transformer $15.00; 9AQB, 6 Thornby, St. Louis.

WANTED—GREBE 13 and Baldwin fones. Sell 5-dial Omnigraph $10; Vibroplex $13.00; M. O'Loughlin, Kennecott, Alaska.

FOR SALE—Grebe CR-9, $65. Used one month, perfect condition. 8DED, Holland, Mich.

"THE BEST IN SUPER-HETS." PULL THOSE AUSTRALIAN TESTS THROUGH WITH A SUPER-HET. OUR SUPERS BUILT OF STANDARD APPARATUS. THORDARSON TRANSFORMERS IN THE AUDIO AMPLIFIER. SPECIAL WAVELENGTH MATCHED TYPE TRANSFORMERS IN THE R.F. AMPLIFIER. COMMERCIAL COMPANIES USE THE SUPER-HET. THERE'S EVERY REASON WHY YOU SHOULD. LOOK HERE O.M. HERE'S ONE REASON, THE PRICE. ULTRADYNE $70.00, SUPER-HETS FROM $65.00 UP. ANOTHER REASON, WE HAVE THE TIME TO TEST AND ASSEMBLE THEM CORRECTLY. PATIENCE COUNTS IN SUPER-HETS. QST SAYS SO. COILS FOR SUPERS AT A LOW PRICE. LOW LOSS TYPE. DIG OUT THAT OLD SPARK OUTFIT. WE PAY YOU A GOOD DISCOUNT FOR THAT STUFF IN TRADE ON A SUPER. AS HIGH AS $30.00 FOR A TRANSFORMER. HOOK UP TO A SUPER-HET FOR RESULTS AND GET QSO WITH THE ENSALL RADIO LAB., FOR SUPER-HETS. INQUIRIES INVITED. THOS. ENSALL (ENSALL RADIO LAB.,) 1208 GRANDVIEW AVE., WARREN, OHIO.

PYREX TRANSMITTING INSULATORS, 8BIN.

NEED A NEW Battery charger? Send 9CVO your old worn out charger and $11.25 and receive a Brand new Valley, type ABC. H. Siebens, 5772 DeGiverville, St. Louis.

3-HK'S COMPLETE 100-WATT CW. Phone, and ICW. Actual cost $290. Send offer or write for list. James Thomas, Ambler, Penna.

BARGAINS—AMPLITONE LOUDSPEAKER $3.00; NUMBER RCA UC-1831 TRANSMITTING CONDENSERS, NEVER USED $5.00, LIST $9.00; THREE FOOT LOOP $1.00; RCA MAGNETIC MODULATOR UT-1643, $6.00; US TOOL CONDENSERS .001 MFD. $3.00; DEFOREST TRIPLE COIL MOUNTING $3.00; RCA KEYS $2.00; HONEYCOMB COILS 25, 50, 75, 100, 200, TURN, $1.00 EACH; WD-11 SOCKET 50c; VARIOMETER 75c; 2LA, ROBERT FISCHER, 52 EAST 41 STREET, NEW YORK CITY.

CODE MADE EASY and interesting. Alphabet in 15 minutes. Easy to remember. Boy of eight learned ten consecutive letters in five minutes. Copyright 1924. $1., Cheques $1.10. Dept. Q., KWIKKODE, 724 Beresford Ave., Winnipeg, Canada.

QSL CARDS printed to order—8BJT.

C.W. TRANSFORMERS. New Radio Corp transformers in their original cases. UP 1016, 750 watt, for 1 or 2 50 watt tubes—$15.00. UP 1368, 325 watt, for 1 to 4-5 watt tubes,—$10.00. W. M. Derrick, 58 North Sixth, Newark, N. J.

PURE LEAD 1/8", 75c Sq. Ft. 8BIN.

$10,000 WORTH OF RADIO Transmitting, Receiving Sets, and Parts, bought from U. S. Government Aircraft Department. We sell at reduced rates. Send 2c stamp for list and prices. Mail orders answered. Weil's Curiosity Shop, 20 S. 2nd St., Phila, Pa.

FELLOW BUG HOUSE INMATES ATTENTION—We can supply you with everything you need for that C.W. Set At lowest prices. Any, or all the parts for that Edison Storage "B" Battery. Solid nickle wire, Genuine Edison Solution "N'everything. Number 12 Solid Copper Enameled Wire and long skinney porcelain insulators for that Ideal Antenna. Chemically pure sheet Aluminum and Lead for Rectifiers. Any size Bakelite Tube, Any size Radiotron Tube. Jewell Meter. Thordarson Transformer. Chokes, Grid leaks, or Rheostats. You can Bet on us for Real Service. Price list for the asking. Jackson's Radio Engineering Laboratories, 102 So. 6th Sts., Waco, Texas. WJAD.

WANTED—Motor Generators—what have you for sale—list your equipment with us. I. W. Myers, Connellsville, Pa.

A BARGAIN—Zenith $85.00 Receiver used as demonstrator, good condition, $75.00. COD or Money Order. Amateur Radio Supply Shop, 525 Park Ave., Kent, Ohio.

EVERYTHING FOR THE HAM—8BIN, E. J. NICHOLSON, 1407 FIRST NORTH ST., SYRACUSE, N. Y.

OLD SCHOOL HAMS—Long anchored at about 15 per have doubled speed in few hours. Their reports tell the story—free on request if mention your call. Method $2.50. Kills hesitation. Dodge Radio Shortkut, Dept. SC, Mamaroneck, N. Y.

STORAGE "B" batteries at dry cell prices. Purchase a rechargeable "HAWLEY" storage "B" battery. Non-sulphating or buckling of plates which means clearer enjoyable reception with unlimited life. Sold in complete knock-down units which requires no former experience to put together. These units contain everything for the actual construction of battery such as large size tested Edison elements, special molded flat bottom glass cells (not ordinary test tubes) punched insulating fibre board for support of cells, pure annealed solid nickel wire Rubber stoppers, perforated hard rubber separators, full strength chemical electrolyte. With all orders there is included free an 8 page illustrated folder showing simple putting together making of charger and charging. Prices of units as above—22 volt $2.95; 45 volt $5.75; 90 volt $8.95; 100 volt $9.95; 120 volt $11.60; 135 volt $12.75; 150 volt $13.90; 200 volt $17.50. Special voltage units put up at no increase in price. Complete sample cell, 35c prepaid. Complete non-heating "B" battery charger $2.75. Extra special 100 volt whiewood cabinet at $2.75 only. Also "A" batteries at attractive prices. Order direct or write for my literature, 30 days trial offer and guarantee. Orders shipt same day received. No waiting. B. Q. Smith, 31 Washington Ave., Danbury, Conn.

BEST OFFER TAKES MY NEW WESTERN ELECTRIC (CW 936) including transmitter and receiver, power amplifiers, loud speaker, switchboard, two motor generators, remote control, etc. WANTED— Grebe CR 9 or will accept in part trade; call or write 3UW, Ernest Roy, Finderne, N. J.

BARGAIN—Radiolas R-C, R-T, and A-R, new condition. Complete with tubes, $125.00. Edward Cooper, Jr., Bramwell, West Va.

LOW LOSS (Squirrel Cage) COIL FORMS—Similar to those used in One Control Neutrodyne page 9 August issue. Carefully constructed of seasoned mahogany strips and Formica rings. Stock sizes; (4" diam. 4" long) (4" diam. 3½" long) (3½" diam. 4" long) (3½" diam. 3½" long) Price $1.50 Cost no more than tubing and infinitely better. Try one in the secondary circuit with a low loss condenser and hear for yourself. Use the 3½" diameter sizes for neutrodyne coils. Special (3 for $4) or 4 for $5) for neutrodyne builders. All forms complete with terminal screws and drilled for mounting posts ready to wind. Carefully packed and shipped postpaid. Quick Service. Special sizes made to order. Low loss sets made to order or designed at reasonable prices. STUART A. HENDRICK Radio Equipment, 85 West 181 Street, Bronx, New York City.

PYREX LEAD-IN INSULATORS. 8BIN.

COMPLETE STORY—as to merit cannot be told—is still in the making. Students constantly report more astonishing results from limited study. As told to date free on request. Method $2.50; kills hesitation; Dodge Radio Shortkut, Dept. SC, Mamaroneck, N. Y.

200-20,000 meter receiver including radiotron $25.00; two step amplifier $18.00; Smith, 4416 Market, Philadelphia, Pa.

REAL BARGAIN (NEED SCHOOL MONEY) 8 tube "super" in walnut cabinet (piano finish) (built by cabinet maker) with built-in loud speaker, Cardwell condensers mahoganite panel, Univernier dials Acme A.F.'s everything the best, guaranteed real buy at $130.00. Another 8 tube "Super" in Oak cabinet low loss "Ohio" condensers, Univernier dials, mahoganite panel, Kellog A.F.'s sacrifice at $90.00. No pains or expense spared on either of these sets. Both will reach out and get them. $55.00 10-D loud speaker like new $30.00 Philadelphia Storage "A" 150 ampere hour cost new $35.00 sell $15.00. All goods C.O.D. Henry Hibard, 221 N. 3rd St., Beonville, Ind.

FREE—Citizens' Radio Call Book, with every order over $15.00. Apco and Fansteel Balkite Charger $15.00. Bristol Audiophones, Senior $23.50, Junior $17.75. Send for Free pamphlets. Western Electric 5 watters, $6.50. Let me quote your needs, transmitting and receiving. Everything new. George Voigt, 56 Maiden Lane, Maspeth, N. Y., Dept. Q10.

LARGE SIZE EDISON elements for that storage "B" battery .05 per pair prepaid. Elements wired with solid nickle wire. SPOT WELDED CONNECTIONS, 7½c per pair prepaid. Sample pair and instructions 10c. Arthur Chapelle, 7NX, Woodburn, Ore.

EDISON B BATTERY EQUIPMENT FOR SALE. LARGEST SIZE TYPE A ELEMENTS 4c, 5c A PAIR DRILLED. 8c WIRED WITH PURE NICKEL WIRE, PURE NICKEL WIRE SIZE 20, SOFT DRAWN FOR CONNECTORS 1c FOOT. PERFORATED HARD RUBBER SEPARATORS ½c. ENOUGH OF THE CORRECTLY PROPORTIONED CHEMICALS TO MAKE 5 LBS. OF EDISON BATTERY SOLUTION, 75c. ANNEALED GLASS TEST TUBES ¾x6" 3c. 1x6" 4c. WILLARD COLLOID RECTIFIER TO CHARGE THOSE B's $1.00. I PAY POSTAGE OR EXPRESS CHARGES. BERNARD STOTT, 60 PALLISTER AVE., DETROIT, MICH.

PURE ALUMINUM $\frac{1}{16}$", 75c SQ. FT. 8BIN.

WHAT OTHERS HAVE accomplished—what you may expect to gain—told by qualifying records 150 students now Licensed. Many are ORS A.R.R.L. Some Commercial Ops. Failures by all other methods have succeeded. Old School Hams increased speed; doubled after memorizing Code our way. Qualifying records and detail reports on request. Method $2.50. Kills hesitation. Dodge Radio Shortkut, Dept. SC, Mamaroneck, N. Y.

20 WATT CW and fone, 2 good tubes, worked all districts, $35.00. Edward Doyle, 1440 Chase Ave., Chicago, Ill.

PARAGON RB-2—Three-Circuit Receiver; Brand New; Tubes, Batteries, $90; Cost $150. Sarber, 947 East Market Street, Indianapolis.

FOR SALE—Grebe 13 in good condition. Mechanically and electrically perfect, $62 prepaid. Also 28 turn edgewound inductance, 4 inches in diameter, $2.50 Prepaid. Bernard Stott, 60 Pallister Ave., Detroit, Mich.

FOR SALE—Advance sink rectifier, practically new, $35.00; 5AAT, Andrew Webre, 743 Government St., Baton Rouge, La.

WHY SINK YOUR MONEY in bare wire for your antenna and counterpoise when you can buy a thousand feet of No. 12 enameled solid copper wire for $6.90? Smaller quantities at 75 cents per 100', carried in 100', 500', and 1000' coils. While you're at it put in Sure Fire insulators—20 inches of beautifully glazed highest quality white porcelain to keep the precious amps where they belong. Only $1.15 each, 4 or more $1.00 each. Pure aluminum and lead for the rectifier. New type all porcelain 5 watt socket 65 cents, fb for the low-loss receiver, lowest loss socket made firm contact on bottom and side of prong. Westinghouse 600 volt 100 amp. lightning switch only $1.50, formerly $5.00. You'll need series condensers for the low wave lengths. UC-1831 variable, now only $2.25, a $9.00 value. UC-1015 7500 volt fixed series condenser, three capacities, $2.00. Don't miss getting one or more UC-1808 .002 mfd 6000 volt Faradon condensers, regularly $7.00, while we list them for only $1.50, a wonderful value for grid, plate, or RF by-pass condenser. We're selling hundreds. Jewell TC Ammeters, $10.80, A.C. filament voltmeters, D.C. plate milliammeters, $6.75. RCA hot wire meters, 2.5 and 5 amp, now only $2.00. Special sacrifice prices on RCA milliammeters, thermo-ammeters, plate voltmeters. Type 4000 "S" tubes, $9.00. UP-1368 power transformer $10.50, UP-1016 $17.50. UP-1654 50 henry 300 mill filter reactor $10.45. PX-1638 chopper $2.40. These prices are only samples—we can't list them all. A card will bring the complete list. Ask us for advance dope on a new coupled inductance for short waves and a new device that will banish forever the filament rheostat in the transformer secondary—just what you've long hoped for. E. F. Johnson, 9ALD, Waseca, Minn.

FOR SALE—Twenty watt CW and fone transmitter with 500 volt M. G., two five watters, and a RCA filament and plate transformer, $100.00; DX all U.S. diats, and Can. Four almost new Amrad S tubes, $8.00, each; a new Thordarson 1500 volt 900 watt plate transformer $25.00; All the above in A No. 1 condition but have to sell as am enlarging station. Write R. H. Jackson, Jr., 415 N. Carroll St., Madison, Wisc., Radio 9EGH.

THAT "HARD TO GET PART", ASK 8BIN.

REPORTS OF RAPID PROGRESS BY Beginner now Radio operator U.S.S. Cleveland yours for asking. See other Ham ads. Dodge Radio Shortkut, Dept. SC, Mamaroneck, N. Y.

WANTED—Parts for 5 or 10 Watt C. W. H. Jones, 3107 So. 14th St., Omaha, Neb.

TWO KILOWATT General Electric, oil immersed, transformer. 110-220 volt primary. 550 1150, 2300 volt. secondary. First class condition, $25.00. Herbert Rickards, 1460 W. Macon Street, Decatur, Illinois.

GREBE tuned radio frequence amplifier, type rorn, $25, 9dnG, Fergus McKeever, Lawrence, Kans.

REAL HAM CONDENSERS—the General Radio kind. 15% off any type, C.O.D., or post paid for cash. Also prompt delivery on tubes and transmitter parts—10% off. 8DDV, Rensselaer Falls, N. Y.

TRY TESTED TRANSMITTING TUBES. 8BIN.

KEY AND BUZZER FAILURES have thanked us for License easily obtained. Their reports tell the story, rap'd progress quick success—free on request. Method $2.50, Kills hesitation. Dodge Radio Shortkut, Dept. SC, Mamaroneck, N. Y.

FOR SALE—ESCO 400 V, 75 W motor generator $40.00; new improved "S" tubes $5.00; 5 watt radiotrons $5.00. All used but little in experimental work. Also transformers and other transmitting equipment. Tell us your needs and what you have to dispose of. I. W. Myers, Connellsville, Pa.

No. 12 ENAMELED WIRE 1c FT. 8BIN.

$5.00 NEW UNITED States Aviators leather Helmet with Head-Phones and Microphone, cost $25. Postage free. Send at once, limited supply; other Radio Bargains. Weil's Curiosity Shop, 20 S. 2nd St., Phila. Pa.

GENUINE SILICON Transformer steel cut to order 25 cents lb. 10 lbs. and over, 4 cubic inches, weight 1 lb. postage extra. Geo. Schulz, Calumet, Mich.

RADIOLA V detector and 2 stages—audio and crystal detector like new list complete $142.50; sell for $55.00; less tubes and batteries; but with 3000 ohm Frost Phone. $5.00 deposit with express agent, balance C. O. D. subject examination, Geo. Schulz, Calumet, Mich.

FOR SALE—1000 volt 600 watt power transformer, $18.00; 375 volt 100 watt power transformer $9.00; 0-2.5 hot wire ammeter $3.50;0-2 thermocoupled ammeter $5.00; 5 watt tubes 5.00; large and small 5000 ohm transmitter grid leaks 75c. Everything guaranteed. John West, 1404 Michigan Ave., Manitowoc, Wisc.

FOR SALE—Transmitter 10 watt CW and tuner complete. I. T. Van Lehn, 477 N. Broadway, New Philadelphia, Pa.

REMLER, GIBLIN and DeForest coils, new mounted only few left as follows—100-150-200-300-400-500-750 turns half list price. Postage extra. Geo. Schulz, Calumet, Mich.

GREBE CR-9 $85; RORN 45. Both of these are new and perfect. Must sell. Also a home-made three-circuit tuner, with two step in separate cabinet. This set is made of the finest parts I could buy, large Gilfillan variocoupler and variometer, write for further description. Lawrence Lottier, 7640 Oakland Avenue, Detroit, Michigan.

BAKELITE STRIPS—for sub panels and antenna insulation to 5" wide any length 3/16 inches thick 100 square inches $1.25 prepaid. Geo. Schulz, Calumet, Mich.

FOR SALE—15 watt CW and fone set. Panel mounted, fine job. $160 complete. New Sherman M.G. Everything guaranteed A-1 condition. Write for details and foto. Going to school, need the money. 9DRS.

PENNANTS—AVAILABLE TO ARRL MEMBERS ONLY. YOU CAN NOW OBTAIN THESE PENNANTS IN OFFICIAL ARRL COLORS, BLACK AND GOLD. YOU WILL BE DELIGHTED WITH ONE OF THESE BEAUTIFUL AND BEST QUALITY FELT WOOL PENNANTS. YOUR CALL LETTERS IN HOOD AT TOP AND LARGE EMBROIDERED LEAGUE EMBLEM BENEATH. TWO SIZES, 8x24 $1.35 AND

9x27 WITH LETTERS ORS $1.60 POSTPAID M. O. OR CHECK. 10% DISCOUNT ON CLUB LOTS OF 10 OR MORE. ERIC ROBINSON, 135 JEFFERSON ROAD, WEBSTER GROVES, MO., 9ASX.

CHEMICALLY PURE aluminum 1/16 thick, 90 cents; ⅛ inch thick $1.80 sq. ft., prepaid. Geo. Schulz, Calumet, Mich.

PURE DC for the plates. GE 350 volt .143 ampere dynamotors with filter for 12 volt supply $18. Holtzer-Cabot 500 volt .07 amperes for 12 volt $22. GE 1500 volt .233 amperes operating from 24 volts $45. Well constructed triple commutator machines. 750 volt tap. Adapted for belt drive $48. When driven will also generate current for filaments etc. Crocker-Wheeler 500 cycle self excited and motor generators. Navy Flame Proof Keys with "Blinker Light" $1.50. Henry Kienzle, 501 East 84th Street, New York.

COUPLED INDUCTANCES—For the new short waves, highly nickeled $15.00; Photo on request 9NX. Capitol Radio Company—8JJ 131 Island Ave., Lansing, Michigan. "Inductances A Specialty."

IVORY RADIO PANEL—Grained white "IVORYLITE" makes most beautiful set of all. Guaranteed satisfactory. Any size 3/16" thick sent prepaid 3c per square inch. Sample free. E. P. Halton, Dept. T, 814 Main St., Fort Worth, Texas.

EDGEWISE WOUND copper ribbon the only really satisfactory antenna inductance 5/16 inch wide, 4 inch diameter 12 cents, 5 inch diameter 13 cents, 6 inch diameter 16 cents, 7-¼ inch diameter 18 cents per turn prepaid any number turns in one piece. Geo. Schulz, Calumet, Mich.

FIVE WATTERS—7½ volt, 2¼ amp. Filament 350 to 700 volts plate. Every one actually tested on a ham transmitter. Your money back if you are not satisfied. $3.50 and parcel post insurance charges. Radio Vacuum Tube Co., 55 Halsey Street, Newark, N. J.

HAMS—Get our samples and prices on Printed Call Cards in ONE, TWO and THREE Colors. Also Radiograms, Letterheads and Envelopes. Hinds & Edgarton, 19 S. Wells St., Chicago, Ill.

NIFTY LOLOSS TUNER with one step $35.00; New Acme 200 watt mounted $17.50 and small Thordarson $4.00 Power Transformers. St. Vrain Bros., Mexico, Mo. 9BRU.

WORKED ALL DISTRICTS—Fifty watt transmitter with tube, $85. Wavemeter, $7. AP amplifier tube, $4. Good Audiotron, adapter, $4.50. Meyers Tube, $2.50. 8AGF.

"TRANSMITTING TUBES, all sizes, prices very reasonable, new tubes and guaranteed "hard", 500 Cycle Generators and Transformers all sizes, Kenotrons and suitable oil immersed transformers for same, all sizes. General Electric 1500 volt, 500 Watt, ball bearing Generators with shaft extending $45. A few 1500-1800 Volt 1200 Watt Esco Motor Generators 2½ H.P. 220 volt D.C. Motors $150. Also other apparatus. J. K. Hewitt & Co., 252 Neptune Avenue, Brooklyn, N. Y. 2RK-2FP.

RADIO CORP. TRANSMITTNG PARTS, all in original cases. UP1368 325 watt transformer, $10; UP 1016 750 watt transformer, $15; UP1626 25 henry 160 milamp. choke, $6.50; UP1653 30 henry 160 milamp. choke, $7.00; UP1627 40 henry 300 milamp choke, $8.00; UP1654 50 henry 300 milamp. choke, $9.00; UC1873 choke trap condenser, $1.00; UC1866 filament bypass condenser, $1.00; UC1806 .002 mfd. 6000 volt mica condenser, $1.50; UC1803 .000025 mfd. antenna series condenser, $.75 UC1846 double tank condenser, $1.00; UC1015 antenna series condenser, three section, $2.00; UM530 0-2.5 hotwire ammeter, $1.50; UM533, 0-5 hotwire ammeter, $2.00; UM576 0-500 milliammeter, $6.00; UM580 0-500 DC voltmeter, $8.50; SA lightning switch, $1.25; UC487 ½ mfd. 750 volt filter condenser, 60c; UT 1643 1½ amp. magnetic modulator. 25c; UT1357 3½ amp. magnetic modulator, 50c; UT1367 5 amp. magnetic modulator, 75c; PX 1638 chopper wheel and brush, $1.50; UP1656 75 watt 7.5 volt filament transformer, $5.00; UP1658 150 watt 10 volt filament transformer, $6.00; PT537 50 watt rheostat, $5.50; UV712 9-1 A.F. transformer, $3.00; UR542 five watt socket, 75c; five watt rheostat, $1.50. W. M. Derrick, 58 North Sixth Street, Newark, N. J.

BARGAIN—100 Watter with 2 Tubes, Filament and plate transformers (Thor) and advance sinc rectifier, $130.00 cash F.O.B. William Soria Janin, Box 337, Pass Christian, Miss.

SELL Paragon RA 10 $20., Detector and 2 step $30., Both for $47., Radiotrons $9 extra. A snap. Other apparatus also. Radio 9DFM.

RAMSEY'S RADIO REVISED—Price $2.00 postpaid. For review of second edition see July QST page 63. Eighty-four experiments, mimeographed. Note enlarged book brought to date. University Book Store, Bloomington, Ind.

COUPLED INDUCTANCES—For the new short waves, highly nickeled $15.00; photo on request 8NX. Capitol Radio Company. 8JJ 131 Island Ave., Lansing, Michigan. "Inductances A Specialty."

BEST GREBE C.R.8 in the state, forty bucks; grab it! Ten watt transmitter complete-sixty dollars takes it. See 9CIN.

WHY KEEP ON Buying Dry "B" Batteries when you can buy an Edison Element storage "B" that will last you a lifetime. Every Battery assembled and wired. Just pour in Electrolyte and charge. 50 volt type "A," $5.50. 100 volt type "A," $10.75. 45 volt type "G," $3.95; 90 volt Type "G," $7.75. Get yours now and stop buying dry "B" Batteries. Type "A" elements (Drilled) 5c per pair. 2¼x6" container 3c. Separator ½c. No. 20 pure nickel wire, 1c per ft. Brand new 2 volt 30 ampere storage cells, 50c each. Several cells can be hooked up in parallel to any desired ampere. J. Zied, 530 Callowhill St., Phila., Pa.

GREBE RORN CR, 3 Rord with H tubes and Philco Storage B. Absolutely new $110. Trade for transmitter, list parts. Osborne Conrad, Stillwater, Minn.

GUARANTEED CHEMICALLLY Pure HiVoltage Rectifier plates riveted together. Pair twelve by one by sixteenth. Twelve cents pair. Other sizes and prices. Postage extra. Cash with order. Apton Laboratories, 597 Bathurst Street, Toronto, Canada.

YOU READ THAT Five watt tube advertisement and we believe that you will go back and read it again. It means just exactly what it says. Your money back if you are not satisfied. The parcel post and insurance charges too. $3.50 is a fair charge for a five watt tube. More than that is excessive. Try one or two and then pass the word around.

NEW GENERAL ELECTRIC ½ H.P. 110-220 Volt, 60 cycle, 1750 R.P.M. Single Phase repulsion induction motors. These are late type continuous duty motors all in original boxes. Price $29.50 each F.O.B. Chicago. 25% with order balance C.O.D. Quantity limited. Queen City Electric Co., 1734 Grand Av., Chicago, Ill.

BARGAIN $35.00.—Grebe CR-5 rewired with Detector and One Stage for 199 tubes. 8DNQ, 1307 South Fountain Ave., Springfield, Ohio.

FOR SALE—2000 Volt 1500 Watt 1750 R.P.M. double Commutator Motor Generator Set, Motor end A.C. 60 cycle $200.00. Also, 2000 Volt 1000 Watt 1750 R.P.M. Motor Generator, Motor 110 Volt Direct Current $125.00. Queen City Electric Company, 1734 West Grand Avenue, Chicago, Illinois.

BEST bid takes any or all of transmitting parts from tubes to transformers. Write for list. D. H. Hiebert, St. Croix Falls, Wisconsin.

GREBE CR3, $40.—Left factory in 1923, same as new. Absolutely guaranteed. What sa? Radio 5SD, 1317 S. 7th St., Waco, Texas.

WANTED—Two used RCA Helixes, Cheap, 8DCF.

SELL—Grebe CR13, $60; Crosley 52, $23; Nightingale 4-tube Receiver, $22; 900 Watt Thordarson Plate Transformer, $22.50, above Brand new. Homade Detector and 2 step, $10; 9BAK's 50-watt Transmitter, heard in 11 countries, $85.00; 5-watters repaired, $3.75. Guaranteed to take 750V. on plate. Thomas Radio Co., Muncie, Indiana.

BARGAINS IN NEW APPARATUS—Atwater-Kent amplifiers, two stage $10. One stage $6.50. TRANSFORMERS-RAC UV1714 $4. Era audios $4; Dongan audios $3; Kellogg Variocoupler $7; VARIABLE CONDENSERS—.001's $3; .0005's $2.50; Bradleystats $1; UV199's $3; UV199 adapters 50c WD12's $4; 201A's $4.50; tube sockets 50c. FOLLOWNG USED APPARATUS-EXCELLENT CONDITION. EVERY-

THING GUARANTEED. ESCO 500 volt 150 watt-10 volt 80 watt, motor-generator. Cost $134. Sacrifice $85. Federal 262-W microphone $4. Radisco variocoupler $2; 100 ampere ground switch $2. Heslar Duo Coupler complete $7. Radiola IV, complete with tubes and batteries. Real buy at $185. Cutler & Ellis, Sullivan, Indiana.

CALL LETTER CIGARETTES—Advertise your station with your Call Letters on cigarettes. Sample Box 20 for 25c. 8BSR. L. F. Strobel, 680 Yale St., Akron, Ohio.

LEAVING FOR SCHOOL will sacrifice my twenty and hundred watt sets. Parts sold separately. Write for list. Box 56 Groesbeck, Texas.

CONDENSERS, N. Y. Coil Co. 43 plate $1. Rotary switches, heavy knob, 3&1-½ in. N.P. blades in ea. box 45c. Variometers, handsome ebony finish, treated wood, DSC, wire, heavy brass bearings, ¼" brass shafts $2.90. WD-11 Sockets, bakelite, (Na-ald) 50c All NEW. Postpaid. Mervine, 608 Parry Ave., Palmyra, N. J.

MOTOR-GENERATOR—750 volt 250 watt ESCO, NEW —$75.00. 9QI, Greentown, Ind.

CW TRANSFORMER—eleven hundred volts, $15. Remler detector-tuner and Crosley two-step, $25. 8GW.

RADIO CARDS—Many different styles. 60c per hundred and up. LARGE RED call letters. Also Radiograms and Stationery. LOWEST PRICES. Send for complete set of samples. THE ARTHUR PRESS, 1453 Arthur Ave., Lakewood, Ohio.

SELL—Kennedy receiver, type 281 with 521 amplifier. A bargain at $55. C. Bailey, 412-11th St., Niagara Falls, N. Y.

COMPLETE—10 watt transmitter. Panel mounted with tubes, filter, transformer, Key. Write R. J. Gleason, 1304 E. 62d St., Seattle.

MOTOR GENERATOR BARGAINS—G. E. Motor 220 Volt 60 Cycles 3 Phase 1750 R.P.M. Generator 400 Volts 150 Watts Ring Oiled $35.00. Esco Motor 220 Volt Direct Current Generator 500 Volt 200 Watts. $35.00. Esco Motor 220 Volt 60 Cycles single Phase A. C. Generator 500 Volt 200 Watts $50.00. 750 Volt 200 Watt 3400 R.P.M. Generator Ring Oiled, only $30.00. Also, others. Queen City Electric Company, 1734 West Grand Avenue, Chicago, Illinois.

COUPLED INDUCTANCES—FOR THE NEW SHORT WAVES, HIGHLY NICKELED, $15.00; PHOTO ON REQUEST, 8NX—CAPITOL RADIO COMPANY—8JJ 131 Island Ave., Lansing, Michigan, "Inductances A Specialty."

WANT FIFTY WATTERS, vibroplex, quiet induction motor—2AJ.

FOR SALE—The following brand new receiving sets, fully guaranteed, at much below cost prices because our customers are almost entirely BCL's who do not take to amateur receivers: Zenith 1-R Receiver and 2-M Amplifier, $90.00; Jones No. 503-J detector and 3 step, $125.00; Kennedy Intermediate with Amplifier, $100.00; Grebe CR-5 Receiver, $50.00; Grebe CR-8 Receiver, $50.00; Grebe CR-12 Receiver, $125.00; Grebe RORN radio frequency amplifier, $25.00; General Radio Power Amplifier (works off lighting circuit) $15.00; Federal No. 8 detector and 1 step, $20.00. The Radio Store, 560 E. Colorado St., Pasadena.

FALL IS HERE—If you need Radio Acknowledgment cards get ours. Samples first. Complete line of acknowledgment and applause cards. Wireless Acknowledgment Card Co., 325 Sixth Ave., McKeesport, Pa.

FOR SALE—Westinghouse Dynamotors 10-12 volt drive 350-425 volt output mounted on bakelite base with filter price $15.00. A few 30-32 volt drive with same output at special price of $15.00. Type M.H. Westinghouse 110 volt A.C. 1000 volt D.C. motor-generator with field rheostat list brand new, $170.00, our price $110.00. 50 watt 203 A tubes $28.00. 36"x36"x7/16" Bakelite sheets fine for transmitter panels special $25.00. We have for immediate shipment R.C.A. U.L. 1008 Inductances, Weston & Jewell radiation, milliamp volt and ammeters. R.C.A. 0-1500 voltmeters 0-2.5 and 0-5 radiation meters, 0-2.5 and 0-5 hot wire meters, filter condensers, by-pass and antenna series condensers. 50 watt sockets transmitting grid leaks, Amrad lightning switches and lead-in and wall insulators. Acme and R.C.A. plate and filament transformers. Ward Leonard field rheostats, and many other items too numerous to mention. Send for our full price list and particulars on anything you need in transmitting material. Troy Radio Company, 1254 St. Johns Place, Brooklyn, N. Y. Telephone Decatur 6139.

HOW ABOUT SOME REAL ANTENNA WIRE OM? GET URSELF SOME No. 12 SOLID COPPER ENAMELLED, AND HAVE A JAM-UP LIFETIME AERIAL. 1c PER FOOT. CUT ANY LENGTH YOU WANT. BETTER INSULATORS THAN OHIO BRASS ARE NOT MADE. 5 INCH 75c 10 INCH $1.50. WIRE AND INSULATORS PREPAID TO THIRD ZONE. FT. WORTH RADIO SUPPLY CO., 104 EAST TENTH ST., FT. WORTH, TEXAS.

WANTED—Western Electrc condenser type microphone, 50 watt to 1 k.w. power tubes, 1500 to 2000 volt 1 to 2 k.w. motor-generator with A.C. drive. Write Phil. Orein 54 Cook Street, Brooklyn, N. Y.

SELL CHEAP—4 five watters $5.00 each, slightly used on power amplifier. Several two stage amplifier sets $10.00; one 200 watt power transformer mounted $10.00; one Copp circuit set complete $15.00; amplifier for same $15.00; 1 Magnavox tone arm $15.00 cash or trade. Two microphones $3.00 each; one C-E wave meter, chart lost $5.00; enameled copper wire and 2" and ¼" copper ribbon 30c lb. wood variometer sets complete 25c, 1 k.w. Thordarson trans. new, can use for C.W. Trans. $12.00; ½ k.w. $9.00; C-E, 1 k.w. Trans. $10.00; rotary quenched gap for same without motor $5.00; 2" ribbon oscillation trans. $5.00; Send money order or check. C. C. Endly, 22 Sturges Ave., Mansfield, Ohio.

AMATEURS—LOOK; WRITE FOR BIG LIST STANDARD EQUIPMENT AT GREAT REDUCTIONS; MANY ITEMS AT 50% DISCOUNT; A POST CARD WILL BRING LIST. COMMONWEALTH APPLIANCE CO., 382 ROBERT ST., ST. PAUL, MINN.

DEALER'S surplus stock of Radio Corporation transmitting parts. .Some as low as two thirds off. Write for list. Hurry. D. W. Pinkerton, Station B, Toledo, O.

WANTED—R. C. U. L. 1008 inductance. Rennaker, 9MM.

100 WATT C.W. for sale. 2APD, distance England, France, California. Am leaving the game. Complete panel mounted, arranged for greatest possible wave variations and lowest losses. Self rectified, separate transformers, all meters and controls. Write for photos and complete description. Price $135, F.O.B. Poughkeepsie. Parts alone cost over $175. Carl Muckenhoupt, 211 East End Ave., Pittsburgh, Pa.

HARD RUBBER—Genuine vulcanized hard rubber sheet, rod or strip. Rough pcs $1.40 lb. 25c per pc on cut to size orders. ¼ Panels 5-10-12-18-24-30 x 8" high and others with ground edges. Phos-bronze ribbon ¼ in. 20 gauge takes rt. ang. bend 3c ft. Copper foil 6" wide x .001 thick etc. Write for list Mervine, 608 Parry Ave., Palmyra, New Jersey.

Q R A SECTION

50c straight, with copy in following form only: CALL — NAME — ADDRESS. Any other form takes regular HAM-AD rates.

1BIQ—Charles A. Kibling, Quenchee, Vt.

1CAK-1ZD-1XAX—John M. Wells, 40 Main St., Southbridge, Mass.

1GV-1ZAB—H. H. Tilley, Woolworth Bldg., Providence, R. I.

1QV—Robert Chapman, 4½ Hillside Ave., Westerly, R. I.

1TE—John E. Wilkinson, 35 Malvey St., Fall River, Mass.

RADIO 1XAQ, 1AEL, 10A, 1ID, 1ASN, Silver Lane, Connecticut, a suburb of Hartford. Operators; S. Kruse, "LQ"; F. C. Beckley, "JS"; A. L. Budlong, "VL"; H. F. Mason, "MN"; all of the A.R.R.L. Headquarters staff.

2AAN—Stanley E. Hart, 19 Marshall Road, Yonkers, N. Y.

2JC—Bloomfield Radio Club, Bloomfield, N. J.

3QV—Walter Bradley Martin, Box 612, Roslyn, Pa.

3RS-3CKC—E. Kampf, 817 14th N. W., Washington, D. C.

5ARI—Meade Johnston, Tuscaloosa, Ala.

5CK—John Mitchell, Havana, Ark.

6BBV—Jack Barsby, 518 W. 50 St., Los Angeles, Calif.

6CTX—Julius Geritz, 160 S. 40th St., Richmond, Calif.

6CUD—George E. Butcher, 911 W. 17th St., Santa Ana., Calif.

8ALI—Max Bauer, 11407 Scottwood Ave., Cleveland, O.

8AUT—Charles S. Monroe, 322 Prospect St., South Haven, Mich.

8BSR—L. T. Strobel, 680 Yale St., Akron, O.

8CNH—Marx Cristman, 232 Prospect St., Herkimer, N. Y.

9APY—Frederick J. Hinds, 3337 Oak Park Ave., Berwyn, Ill.

9BAB—Carl Teten, 3931 4th St., Des Moines, Ia. All QSL's answered.

9BM—E. F. Horn, 2017 Hudson St., Denver, Colorado.

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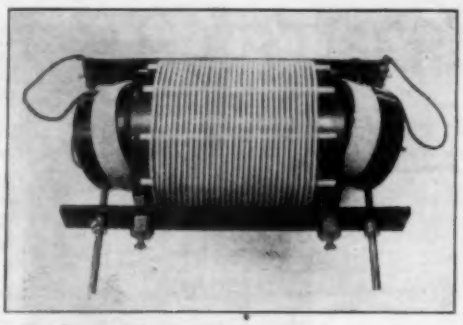

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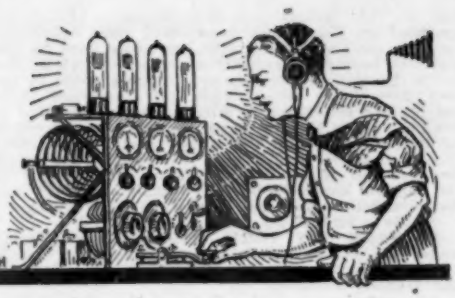


What a splendid month last month was for amateur activity! Real old time amateur activity stands out in each report. Yes, we guessed right, it was the short waves and the abolution of quiet hours that did it. Notice the fine report of the Central Division—a real report for summer and a barometer on amateur radio. Thanks gang.

We had a chance to look over the Memphis stations during the Delta Convention. Such masts and neat stations we never saw before. There are not many stations, but those that are there are stations. Ask 9AAW, Schweitzer, for further information.

OFFICIAL A.R.R.L. BROADCAST messages are transmitted every Saturday and Sunday night—80 meters at 8:00 P.M., and 150 to 200 meters at 10:30 P.M., standard time. The latest information from Headquarters is contained in these broadcasts—don't miss them.

BRITISH AMATEURS are using waves between 115 and 130 meters with several stations around 110 meters, working nightly trying to hook up with us. They have more power and the experience of last year—keep an ear out for them around 8:00 P.M., E.S.T., and later—they are rarin' to go.

Hereafter, only reports of stations holding the new O.R.S. Certificate will be included in *QST*. If you have not received your certificate, make application to your Division Manager for one. A monthly list of Official Relay Stations will be prepared and mailed to each O.R.S. to facilitate the handling of messages. The list will be arranged alphabetically—if your call doesn't appear, you have not taken out the new certificate. All old certificates have been cancelled automatically.

With the creation of the Hudson Division, the following corrections are to be made for the Atlantic Division. Southern New Jersey consists of five districts, 5 to 9 inclusive. District Nr. 5 comprises the counties of Sussex, Morris, and Warren. District Nr. 7, Burlington and Atlantic. District Nr. 8, Camden and Glouster. The other districts remain the same. New York districts in the Atlantic Division are from 6 to 16, inclusive. District Nr. 8 now covers the counties of Schoharie, Montgomery, Delaware, Otsego, and Herkimer. The others remain the same.

The Hudson Division takes the New Jersey districts 1 to 4, inclusive and the New York districts 1 to 5, inclusive. NEW JERSEY District Nr. 1, counties of Bergen and Passaic; Nr. 2, Essex and Hudson; Nr. 3, Union, Middlesex, and Somerset; Nr. 4, Ocean and Monmouth. NEW YORK District Nr. 1, Nassau and Suffolk; Nr. 2, Westchester, Putnam and Dutches; Nr. 3, Columbia, Renssalaer and Washington; Nr. 4, Rockland, Orange, Ulster, Sullivan and Greene; Nr. 5, Albany and Schenectady. Further announcements of the personnel of the Hudson Division will be made in an early issue of *QST*—Glaser is the new D.M. and he is lining the men up for action.

ATLANTIC DIVISION
C. H. Stewart, Mgr.

EASTERN PENNSYLVANIA—No station activities reported this month although quite a few more on the job handling traffic. 3CHG reports hearing New Zealand 4AA. 3ZO is building an 80 meter transmitter.

Traffic: 3BOB, 10; 3ZM, 6; 3MQ, 12; 3TP, 17; 3UE, 1; 3AQG, 26; 3OG, 35; 3ZO, 94; 3BTU, 19; 3FS, 15; 3HD, 7.

WESTERN PENNSYLVANIA—Dist. No. 8: Activities reported as very dull for the month as all of the hams are either enjoying the outdoors or rebuilding their transmitters.

3AOX makes his regular report. 8AKI will be on the air every night after broadcasting period on the regular ham waves with a 100 watt Western Electric phone or C.W. set.

Dist. No. 9: Out of all the stations in the 9th Penna dist. the D.S. has picked a number which report somewhat regularly and show a greater amount of activity than the rest. There is no fixed number of stations that can qualify on this "active list" but at present the list consists of the following fifteen stations: 8LW, 8CTP, 8VN, 8ZM, 8VQ, 8UT, 8CEO, 8BW, 8QD, 8LL, 8CDC, 8CIX, 8JW, 8BXQ, 8DLI and 8BJT. All these stations are not 100% active but they have shown a reasonable degree of reliability and are thus labelled as "active stations." 8CDC reports good DX but little traffic. 8CIX has been on all summer. 8DLI just put up a new 50′ pole. 8JW is putting in a 20 watt set. 8BXQ has changed to Master Oscillator. 8CEO is forced to stay off the air later in the evening due to ill health. The D.S. will have his station on the air again. A new "Z" license has been secured—8ZAH. The A.D.M. is also back on the air with call letters 8ZD in his new home and has done some very good work. 8ZAE is building a new home. 8BGZ's station is being completely overhauled. 8AEY completed a new antenna system. 8DIZ always something doing with a 5 watter. 8JQ as usual tops the list this month both in mags handled and the best report. 8SF has been busy putting their joint station in operation. The poles and the antenna are up. 8BHJ is going strong and is QSO about 1000 miles in every direction but south. 8AGO is just back from his vacation and will be on nightly soon with a new 100 watt set on 80 meters. 8ALE is a new station using one fiver. 8AYW blew one of his fifties.

Dist. No. 10: 8KQ, 8CCK, 8ADS and 8BYI are the only active stations reporting this month.

Traffic: 8DIZ, 4; 8AEY, 9; 8NH, 6; 8JQ, 30; 8SF, 29; 8BHJ, 19; 8CVX, 13; 8AGO, 12; 8ALE, 11; 8AYW, 8; 8DHW, 4; 8CMH, 14; 8CCK, 19; 8ADS, 2; 8BYI, 5.

DIST. OF COLUMBIA—All stations have taken a slide down the wavelength scale and are work-

ing on 75 meters or thereabouts. 3BE-3ZW, operated by 3JJ, shows promise of great reliability for the coming winter. 3OD has come back to life and has beside its regular operator, old 3KM, the latter, by the way, threatened to break loose in his own name very soon. 3LR has immerged from his regular beauty sleep during the summer and is tuning up for the icy days. 3BWT can be relied upon and is one of the most consistent stations in the district. 3AHP is a station that we would be proud of if he thought just a little more of the terrible key click he has. 3BSB and 3BPP are busy experimenting with low wave transmitter.

Traffic: 3BWT, 69; 3HS, 15; 3BSB, 7.

EASTERN NEY YORK—This is the last report under the Atlantic Division. Starting next month, the Eastern New York report will be found under the Hudson Division.

All existing A.D.M., D.S., C.M., and O.R.S., certificates are being cancelled by the Hudson Division Manager, 845 E. 13th St., Brooklyn, N. Y. for re-placement by new certificates issued under the Hudson Division. This is also taking place in Northern New Jersey.

Hereafter, all C.M's, in the Hudson Division except in N.Y.C. will report to their D.S's, sending them all Form 1, O.R.S. cards received. The D.S. will transfer the reports to a single report made on Form 2 sheets with any remarks that he may care to make. The C.M. will report to the D.S. not later than the 19th and the D.S. will report to the A.D.M. not later than he 23rd of the month. The A.D.M. will make out a complete typewritten report with the traffic totals all together at the end of the report to the D.M. before the first. ONLY STATIONS ISSUED THE NEW O.R.S. CERTIFICATES UNDER THE HUDSON DIVISION WILL SEND IN REPORTS AND THESE REPORTS MUST BE MADE ON FORM 1 O.R.S. CARDS. To be issued an O.R.S. certificate, the applicant must be a member of the A.R.R.L. and must sign an application blank designed for that purpose. If the C.M. or D.S. deem the applicant eligible for appointment, the D.M. sends the applicant an O.R.S. certificate WHICH MUST BE SIGNED AND RETURNED TO THE DIVISION MANAGER DIRECT FOR HIS SIGNATURE. Then the certificate is numbered, sent to the O.R.S. and record sent to A.R.R.L. Headquarters. The station may hold the appointment as long as the operator is a member of the League in good standing and provided that he does not violate the conditions of the oath. All O.R.S. must use the method of numbering messages described in June QST. An official of the traffic department is privileged to drop in at any O.R.S. and ask to see the records of messages handled as well as the messages themselves.

2CWR will open up soon with a 50 and many improvements. 2CRQ was away for a while.

2CQO AT ELIZABETH, N.J. TEACHES DRIVING OF CARS

2BRX keps pounding away always asking for traffic. 2CYK is back from his voyage.. 2CVU is a new station to report. 2CWP is a consistent worker. 2AAI has rectified and filtered his raw A.C. and gets out much better. 2WC has changed to a coupled circuit which has improved his sigs and his DX a great deal. 2PE will be going on 80 meters soon. ABN has been heard in France. 2ABR is a very regular station which will probably be an O.R.S. soon. 2BRB gets reports saying he is the loudest two heard on the 75-80 meter band. 2ALC will be an O.R.S. before long. 2AX has gone away on a vacation. 2CHK went away and told the Manhattan stations to report direct to the A.D.M. 2CZR, 2CIZ, 2BNL and 2TT reported. 2CIZ was away most of the month. 2TT is using low power "B" battery supply and doing good work. 2AVE and 2BNC will be going again soon. 2BCK is going again. 2AIT is a new station in Astoria, L. I. 2CEV junked the spark at last. Hooray! a 100 watter will be going soon. 2CEP is the only other station doing anything in S. I. L. I. is dead except for 2CJS, the summer station of 2BRB. 2CXB and 2BPB are on once in a while. 2BQB, who is taking 2UA's place temporarily, sent in a fine report for district 2. He has been away but handled 24 mags. in four days. 2DJ is going on a 900 cycle spark. 2CTB, the White Plains High School, will be going on a 50. 2ASO is on very seldom. 2CVJ is quite active. 2AIG is a new station at Rye Beach. 2ADD will be away at school but will keep his job as C.M. 2AAC is on very seldom with the ole boiler factory. 2APY is still the best DX station in town. 2AQH has put in two five watters. 2BGD is getting along nicely. 2CIL has a job that keeps him off the air most of the time. 2AAN uses two 201s. 2CZD is going to school soon. 2CFE will be going soon. 2CDH will be an O.R.S. soon. 2ANM hasn't been doing much. 2CHZ went to the Poultney convention with the Schenectady gang and had a fine time. 2CYM is doing good work on low power. 2CXG will be going again soon with a new cage. The D.S. visited 2COW and sez it's an Amateurs Paradise. There are fifteen receivers and several transmitters. 2AGQ continues his good work. The height of the QRN season finds only one fifth district station on, 2CGH.

A new antenna for short waves is under construction at 2GK. 2GK, 2BY, 2ACS, 2AAZ and 2CGJ attended the Vermont convention. The Radio Club now has 20 active members. 2CPA borrowed a lot of stuff to open up again. 2ADM is using a 250 with raw A.C. (Cut it out, OM!) 2CWJ is known as Schenectady's Sleepless Wonder. Hi. 2GM is a new station.

Traffic: 2CRQ, 104; 2BBX, 83; 2CYX, 56; 2AAI, 33; 2CVU, 26; 2CWP, 19; 2EE, 18; 2BRB, 111; 2BR, 34; 2CHY, 27; 2ADC, 14; 2WC, 13; 2PF, 11; 2CHK, 21; 2CZR, 33; 2BNL, 8; 2CIZ, 5; 2TT, 5; 3AIT, 58; 2BSL, 6; 2BNC, 2; 2CEP, 18; 2CEV, 8; 2CJS, 27; 2CXB, 5; 2BPB, 4; 2BQB, 24; 2ADD, 30; 2APY, 10; 2BGD, 36; 2CIL, 11; 2AAN, 15; 2AAC, 3; 2AQH, 42; 2CZD, 7; 2CDH, 85; 2ANM, 17; 2AQR, 56; 2AGQ, 49; 2CHZ, 32; 2CYM, 12; 2COW, 10; 2CGH, 78; 2CWJ, 68; 2ACS, 59; 2GK, 23; 2BY, 32; 2ADM, 14; 2CPA, 6; 2AAZ, 4; 2GM, 4.

WESTERN NEW YORK—This months report has dropped off due to vacations, QRN, etc, but nevertheless the gang has done nobly considering the conditions. 8AMR now using 20 watts in 4 coil Meissner circuit, was heard in England on one 5 watt tube in loose coupled Hartley circuit. 8NB has increased to 100 watts. 8AMQ, using 50 to 150 watts using "S" tube rectification. 8AFN is erecting new masts. 8TR has been off due to QRN, but will be QSO in the fall with 100 watts. 8BCP has been heard in the Pan-American tests, using a 50 watter. 8TC will open up with a 250 watter soon on 500 cycles. 8BUM has moved to New York City. 8AXN, who has been on the air for a good many years and the D.S., has resigned on account of leaving home for a better education. 8DAA has one of the best stations in the district and most any night he is busy informing the gang what is going on in the A.R.R.L. as to news and tests. 8BOE has been reported off the air for one month. 8DCA is also off the air for a month.

The U.S.S. STURGEON BAY had many messages and a newspaper report of its 2200 mile cruise. The cruise was enjoyed by all officers and men, some 250 in all. Chief John C. Haderer, prewar 8QB, and chief formerly of N.A.M. was in charge and 8CAN, Loyd and Morrison were his first-class assistants. The U.S.S. Sub Chaser 437 was in charge of 8PJ who also belong to the outfit, and his assistants were 8BOE and 8DGA. Note: The Naval Reserve Forces around Rochester and Dunkirk are in need of some recruits who have good radio stations so it can communicate throughout the year with its own members.

8WU spent the summer up in the Canadian north. 8ALM has the loudest station out of here from reports. 8QB reports traffic slow this month due to many stations reporting off for improvement. 8KU has been on quite a bit on about 160 meters and is doing good work. 8BSF has improved his station wonderfully since moving to Williamsville a suberb of Buffalo. 8AGW and 8OX got through fairly well. 8CTK has been rebuilding and was presented with his O.R.S. certificate. 8AMQ received his O.R.S. certificate also.

8PJ and 8ZB have handled traffic quite regularly with 8AW and 3ZO during the hot months. 8BIC has improved his station wonderfully and is doing very good work using two 50 watters. 8FE allowed his foot to slip and got married. (Congratulations, OM) The following O.R.S. certificates have been issued: 8BQB, 8CTK, 8AQM, 8ABX, 8DKL, 8BHM, and 8DDV.

Traffic: 8AMQ, 12; 8AQM, 17; 8AY, 7; 8BQN, 9; 8BLP, 9; 8BSF, 11; 8HJ, 8; 8KU, 8; 8PJ, 12; 8QB, 12; 8NB, 8; 8ZB, 9.

NORTHERN NEW JERSEY—2BMR is the star station for the month handling the largest amount of traffic. 2CQZ is down on the low waves and having trouble making the ammeter move on 40 meters. However, he has no trouble working 8's any time of the day. 2ACO has again deserted his Y.L. and it's because a fifty went west? 2BXD is the chief operator at 2XBF, a local power company, which is comtemplating a 1KW C.W. on short waves. 2CBP is moving and is hoping that he lands in a decent location which has been lacking for some time past. 2WR has in sight a new location where two 85' sticks are planned. 2MN is getting back on the air again with low power. 2CMK is rebuilding and plans a much better kick on the air this fall. 2FC has the sea-shore route working and mags are moving through short towns in fast shape. 2BGI is heard on consistently. 2CRP's sigs will be absent for at least a month. 3BBH and 3OH are in the 6th district. 3CBS, though recently married, will make a come-back on the air shortly. 3CS-3ZI can't wait for Christman as Santa has promised him two masts. Hi. 2CTQ and 2BKR never fail with reports.

Traffic: 2BMR, 271; 2BXD, 168; 2BKR, 142; 2ACO, 53; 2CQZ, 51; 2BGO, 40; 2CTQ, 39; 2BEO, 26; 2BZJ, 24; 2CYQ, 21; 2CYW, 20; 2AHW, 13; 3CBX, 12; 3XAN, 12; 3ACC, 11; 2ACD, 11; 2WR, 10; 2AUH, 12; 2AZY, 11; 2CRW, 8; 2CXD, 8; 2CJU, 3; 2EG, 2; 2QS, 1; Southern N. J.: 3AIH, 15; 3BAY, 8; 3BEI, 10; 3BTQ, 6; 3BWJ, 3; 3CHH, 8; 2BGI, 35; 2CGK, 11.

MARYLAND—3APV handled 48 mags. His station is down on 80 meters. 3SF is down on short waves. 3APT is putting in 100 watts for the coming season. 3XAQ-3TE left France on the first of September with a 250 watt bottle. His return to the states will be watched with interest by Baltimore men.

Traffic: 3ZD-3APT, 46.

WASHINGTON—Traffic has taken a big slump in this state. There seems to be enough stations going but many seem to have forgotten how to QSR messages. (What's the matter, gang?—D.M.) Interest is picking up again in Seattle and several 50 watters are in prospect for this fall. 7AEZ came back for three nights but went out to sea again. 7MA has his dad pounding brass now (60 years old!) (FB, vy.) 7ADP has moved and is getting his place into shape again. 7DU is back with a new 50 and is down on 70 meters most of the time. 7FD discovered that one of his fifties is a dud. Works ok until it gets hot and then stops oscillating. 7UU is showng life but no traffic. 7CA is still on the job. 7DC, 7AIF and 7PM (ex-7WS) will be on shortly. We regret very much that 7NO has had to quit the radio game indefinitely. 7BM, with a 5'er does fine QSR work. 7NW with a 50 reaches out in fine shape. 7QX is putting up a new 80 foot stick. 7SH comes on at rare intervals. He won't be on this winter on account of school QRM. 7KV is rebuilding nearly everything. 7LH is back and will keep schedule with Alaskan 7AEB where 7NO left off. 7DM gets cards from 8's and pushes some traffic along. 7MI is back on the air for good. 7IX is QRW with ranch work, so radio will be a side issue for a while. 7GE-ZX is remodeling for short waves. 7RY reports a lot of experimenting.

Traffic: 7NO, 93; 7RY, 32; 7GY, 30; 7DM, 27; 7IX, 27; 7PZ, 23; 7BM, 21; 7NW, 20; 7MI, 16; 7QX, 15; 7SH, 13; 7ADQ, 12; 7GE, 11; 7AEZ, 9; 7MA, 9; 7FD, 8; 7KV, 6; 7MV, 5; 7CA, 4; 7LH, 3; 7AIB, 2.

CENTRAL DIVISION
R. H. G. Mathews, Mgr.

KENTUCKY—Traffic has been at nearly a standstill the past month. There is a new station in Frankfort, 9CDP, who promises to be a real DXer. 9EPB is a new station in Lexington that will be going soon. 9ELL is putting up a 70' wind-mill tower. 9HP is stepping to the front and will soon develop into a good relay station. 9WU will be open for BIZ in a few days. 9CON reports WX too hot for active work. 9EP's Chem. Rect. jars dried up.

Traffic: 9BAZ, 36; 9DJN, 6; 9CON, 5; 9MN, 4.

ILLINOIS—Dist. No. 1: 9VM has his set overhauled now and will be on regularly. 9NQ has one 5 watter now with A.C. on the plates and also has the old spark ready for instant operation. (By the way, has anyone noticed the absence of the sparks in Illinois now?) 9BIZ, 9BZQ, 9BWA, 9DBP, 9DGA, and 9LE report only message totals.

Dist. No. 2: The shining star is 9BRX who leads with a total of 300 messages. 9BRX is vacationing at Saugatuck, Mich. He reports that he has "low-lossed" everything in his station and is transmitting on 42, 78 and 150 meters. (FB, OM!) 9CTF reported via Western Union. 9AHQ will be closed until he gets another 50 watter.

9PQ had MG trouble but is going again. 9DXL will be on more regularly when school starts. 9DLO has been trying a few meters below 176. 9AIC has been so busy that he hasn't had time for "Ham" work. 9BJT, along with 9BTA and 9ABE will be attending Dodge's Institute in Valpo this month. 9AHO of Fairbury is still rebuilding and will have from 5 to 20 watts A.C. this fall. 9CA has been making some tests with different circuits and after using the 1DH for a while has come to the loose coupled Hartley as being the supreme "berries."

Dist. No. 3: 9MC is not yet back from his western tour so Fraley sent in the report. 9CMN of Granite City turns in the largest report in spite of terrific QRN. 9ATT is arranging a schedule with 8BCB which accounts for the low message total. 9AHJ says QRN is too bad. (Not if you use a smaller receiving aerial, or none at all.) 9CMC is building a 70' tower. 9CSW says he will be going next month on the low waves. Heavy A.R.R.L. Broadcast Messages the last few days accounts for no messages being handled at 9MC.

Dist. No. 4: 9DHZ is on occasionally with two operators using C.W. only. The only familiar spark is NM. 9BGG is back from his vacation and is getting things ship-shape for fall and winter work. 9BEB continues to do good work and will be glad to test with others on waves of 40-43 meters. 9DCR's address is 410 S. Neil St., Champaign, Ill. 9AP is going in for 80 meters stuff with 2 fifties for power. 9CZL piled up a total of 274 which is very good considering the weather. 9DQU is still knocking 'em dead on 150 meters and will soon be on 80. 9DQU worked three sixes and two sevens on an early hot August morning. 9BHX and 9CLJ are still rebuilding and will be on the air before next month. 9VV is preparing to wreck the ether before fall with a 100 watter.

Dist. No. 5: 9BLO is putting in 20 watts to be suppled with 600 v of Edison "B" batts. 9AMS is reported on a ship. 9EBQ reports QRN, etc. and a small total. 9AYB comes in with one message. 9BDA is reconstructing.

Dist. No. 6: 9AKU, the D.S. of Nr. 6 has been running around the country. 9DQR and 9DJO are putting in a big set together at 9DQR. 9XD lost his station site and is looking for another. 9DNP is putting up one of the ex-KB masts. 9BQW won't be on this winter at all he says. 9CDY has changed to coupled circuit and with a better antenna is getting out better. 9DQR and 9DNP are tickled with their O.R.S. appointments. 9ALW has been on the job but says messages are scarce. 9AJH looks hopeless, his aerial is down, shack gone and everything. 9BHD thinks there should be a 1000 meter wide band for amatuers from the way he gets QRM. Did you ever stop to think that the band between 4 and 5 meters is four times wider than the band between 150 and 200? When you get down there you measure your

wave with a yard stick. 9AKU is getting his masts painted and has been experimenting some with the set.

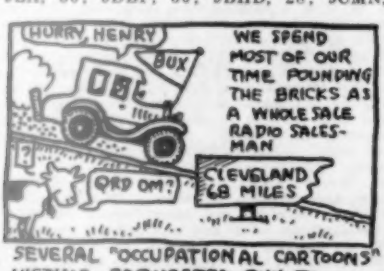
Dist. No. 7: Bill Schweitzer is still away but is expected back in a week or so. He attended the Memphis convention. EQ and KN "liberated" the report this month. 9DWX says the longer the summer, the shorter the traffic in Chicago. 9RC was not on the air much last month, and no traffic handled. 9CCJ, a new comer this month, leads the district. (FB, OM!) 9AXT managed to put 21 through. Nothing new at 9DKK. 9DWX gives message report only. In the absence of 9AMZ, 9DHQ sends in the C.M's report for Evanston.

OHIO—Dist. No. 1: Toledo showing lots of pep, six stations reporting. 8DFF is in Indiana on vacation getting his pep back. He will be on 75 meters on his return home. 8CIE says no mags on account of all being on vacations. 8DCF is touring the east. 8AVN is just back from an auto trip through the east. 8GD is remodeling. 8AGP has a burned out transformer. 8EG is finding 80 meters FB. 8CCI is now using C-303 A and is FB. 8DND, a new station sends in report this month. (Cum again, OM—A.D.M.) 8AA had the pleasure of meeting the Toledo gang in Findlay July 30th where a Banquet was held in the Elk's home. After a few discussions a visit was made

A GANG AT THE MADISON (WIS.) RADIO CLUB PICNIC
Front Row, Left to Right; O. C. Austin, C. S. Polacheck, 9COI, 9ELV, 9EGW, 9CPT, 9DZV, 9DDH. Back Row, Left to Right; 9DUJ, Earl Vogel, 9DNU, 9BBV, 9BMY, Sidney Schafer, 9DVB, 9ELD, 9CII, 9EKH, 9DCP.

9EEG reports he is rebuilding transmitter and will be on next month. 9XBG is on with "B" battery supply. 9BBR has his two five watters perking now. 9DHQ changes location of set from 1st floor to basement in anticipation of several ops working the set this winter. 9DHQ changed from ground to CP and apparent radiation jumped from one and half to 4 amps. 9EDG has rebuilt his transmitter and is going to put in a 50. He is waiting for the tube now. 9DBF is working WHU regularly and in a report from WHU to the A.D.M., 9DBF is given as the best Chicago station. 9DBF is getting out very well in other directions too. His latest reports are from A3QB, Z3CA, Z3AF, Z3AL. These reports include reports on his sync. chem. rect. and A.C. power supplies. 9DHQ sent a message to Hillsdale, Mich. via 8DJH in Gand Rapids AND THE MSG GOT THERE THE SAME DAY. 9BNA has a 50 now and has changed his QRA to 1017 Pleasant Place. 9COW buried three more fives. 9CLX is on an eastern tour and will give some 2's the OO. 9CVS is using a coupled Hartley and says it is FB.

Traffic: 9BRX, 300; 9CZL, 274; 9CTF, 240; 9CVF, 72; 9DQU, 67; 9AMR, 66; 9BNA, 54; 9ASA, 47; 9AHQ, 44; 9DGA, 42; 9DHZ, 40; 9PQ, 38; 9CFS, 37; 9DNP, 34; 9CCJ, 32; 9DWX, 30; 9DBF, 30; 9ZA, 30; 9DBP, 30; 9BHD, 28; 9CMN, 28;



SEVERAL "OCCUPATIONAL CARTOONS" VICTIMS REQUESTED BUX TO DRAW UP HIS OWN OCCUPATION

9LE, 27; 9EBQ, 25; 9CDY, 24; 9AAW, 24; 9AYX, 24; 9VM, 24; 9DKK, 22; 9AXT, 21; 9BFX, 20; 9CA, 19; 9DCR, 16; 9BGC, 15; 9BEB, 14; 9NQ, 14; 9BIZ, 14; 9DXL, 13; 9ATT, 13; 9CLZ, 13; 9DPL, 12; 9DZG, 11; 9ABB, 10; 9DLO, 6; 9DVW, 6; 9DHQ, 5; 9BWP, 3; 9AHJ, 3; 9ALW, 3; 9BWA, 2; 9ARM, 2; 9APY, 1; 9DJG, 1; 9AYB, 1; 9AKU, 1; 9EJH, 20.

to the local stations.

Dist. No. 2: 8AAJ and 8WE handled the bulk of traffic this month. 8RY was heard by ZCDM 6400 miles from U.S.A., also reported by Cuban 2BY. He also worked 8XT at 6CGW. (FB, OM!) 8XT, 8ZE and 8GX have been off the air but are going again. 8WE wants daylight schedules.

Dist. No. 3: 8BKM reports copying WNP on July 19th working 1BVR. 8HS is using Meissner circuit. 8TT is working west coast now. 8AQ is using very low power. 8BNH on 80 meters with 2 amps is working good DX. The Northwestern Ohio Executive Radio Council held a picnic at Lake Milton near Warren, Ohio, at which nearly 100 were present.

Dist. No. 4: 8ALW doing good, considering how busy he is with convention work. 8CAB is doing all his work in the morning. 8APP is a new staton doing consistent work. 8BMB has 4 ops and says they never sleep. 8ANB put over another PRR test again. 8AIB will be on with 250 watt tube. He had his others stolen. 8CNL is on an auto tour. The YLs are doing more damage to traffic than OM, QRN in Dayton.

Dist. No. 5: No reports from this district this month. It is discouraging for stations to handle traffic and make reports to D.S's and have them die there—A.D.M.

Dist. No. 6: Our D.S. has just returned from tour through east which accounts for no report last month. 8AK will be on soon with 20 watts and 200 watts. 8AJD is rebuilding including a new pole. 8BVK will be leaving for Chicago, soon.

H. C. Storck, 8BYN, 694 Carpenter St., Columbus, Ohio, has been appointed R.M. of Ohio. Anyone wanting schedules please write him at once—A.D.M.

Traffic: 8BMB, 155; 8BKM ,87; 8HN, 85; 8BHE, 48; 8BPL, 41; 8CCI, 38; 8BN, 38; 8AQ, 38; 8AVX, 34; 8ALW, 34; 8TT, 30; 8CUD-8DQC, 29; 8CMU, 29; 8AAJ, 29; 8WE, 27; 8BWB, 25; 8DMX, 25; 8APR, 25; 8UQ, 21; 8ANB, 21; 8BAX, 18; 8AWX, 18; 8CVH, 16; 8APP, 16; 8CWR, 15; 8CAB, 14; 8CBL, 12; 8DGP, 12; 8RY, 12; 8AHY, 10; 8BGF, 10; 8AWN, 9; 8BO, 9; 8DOS, 8; 8BP, 8; 8EF, 8; 8DND, 6; 8ER, 5; 8BNH, 4; 8ACK, 4; 8AJD, 4; 8WY, 3; 8CNR, 2; 8CYT, 1; 8BTC, 1.

WISCONSIN—Dist. No. 1: 9BTK recently visited Chicago stations 9LZ, 9RC and 9AAW. 9CII had received a card from CB8 in Argentina who heard him in Pan-American tests. 9DTK in partnership with C.S. Polacheck is putting in 100 watts. 9AFZ labored 2 hours to get a 97 word msg. through heavy static. (Attaboy!) 9VD on the job occasionally when not busy with traffic meetings. 9AAP, 9CVI, 9ELV, 9CGB will be back on the air this month.

Dist. No. 2: 9EAR reports traffic scarce and QRN terrible the past month. 9EGW says his mast was down for two weeks. 9AZR says the Y.L. has got his number and can't afford a new 5 watter now. 9CWP has worked all districts and Canadian threes and fours. 9DCP has been in northern parts for two weeks. 9BIB has been reported heard in England on 10 watts. 9DBM lost a pole in a recent wind storm. Is using "S" tubes now, and says FB. 9BMK is a new station at Racine (ex-9TL) using 50 watts. 9CCF is back on the job after a long illness and going stronger than ever.

Dist. No. 3: 9EMB will have 20 watts and an 80' tower soon. 9AEU is putting in another five watter in a loose coupled Hartley. 9CJI lost his antenna. He is experimenting with a master oscillator. 9AGT will be on soon with 100 watts and two operators.

Dist. No. 4: 9ALI is the most consistent station and maintains daylight, noon, and 5 P.M. schedules. 9AZN working at 12:40 and 5:30, daylight, covered five states on 1 fifty. 9AQD formerly of Rockford, Ill. is now at La Crosse using a master oscillator. 9BLF is not on the air due to the lack of thermionic triodes! 9BSO reports QRM from rustic activities. (He is workng on the farm.) 9BKC is remodeling his antenna system for 80 meter work. 9CFZ has no msg. report for this month.

Dist. No. 5: No traffic reported. The D.S. says everybody is getting down to 80 meters which is putting the "kibosh" on traffic handling for a while. Hurry up and get those 80 meters sets tuned fellow, and let's get back on the job. We must keep our traffic organization going, whether it be 40, 80, or 180—we can't afford to slow down now.

Traffic: 9ALI, 113; 9CCE, 68; 9BTK, 64; 9EAR, 54; 9CII, 38; 9EMD, 35; 9EGW, 33; 9COI, 25; 9DTK, 24; 9AZR, 24; 9AEU, 24; 9ALA, 24; 9ADP, 23; 9AZN, 16; 9CWP, 13; 9BIB, 12; 9BYJ, 12; 9DCP, 10; 9AZF, 9; 9CJI, 9; 9VD, 8; 9AGT, 7; 9CZE, 6; 9PJ, 6; 9DST, 5; 9BMY, 5; 9EGH, 4; 9NY, 4; 9BVA, 3; 9AQD, 2.

NORTHERN INDIANA—Dist. No. 1: 9BON knocks them all dead and is making up for lost time—he handled 224 messages. He uses only 10 watts with a sinc rect. 9EFZ is radiating 5 amps with one 50 watt tube and is doing good work. He is installing a transmitter for 9BBK at Moon. 9DHJ will be on the air shortly with C.W. instead of spark. He is putting up a cage aerial. 9BPT, the prominent boy from Flora, breaks the ice with his first report. He copped the prize at the Indiana convention, a dandy Low-loss tuner. 9DYT is putting in a new filter. 9BMC came across with a report this month. 9CP has not been on since last month due to rebuilding. 9HR is on the air with a 20 watt set. In the first three nights of operation more work was done than ever on the "old Coffin."

Dist. No. 2: The D.S. has been trying to grab a little vacation but finds it hard to do. 9DHD is rebuilding. 9BYI is on the air but no traffic. 9CEM is rebuilding. 9BQN has been on his vacation. 9BUN is using one 5 watter. 9CGX is going to Cornell. 9DHO will be on in about two weeks. 9BUJ is rebuilding his set for work on 70 meters. 9BRS says no traffic coming his way. 9DCE sold his 50 watter but will have a 10 or 20 going in a little while. 9DMI says his Edison "B's" are FB, and he works east coast easily on 10 watter. Things are very dull in Muncie. 9EG is putting up a new aerial. 9EJU getting ready to open up with a new 20 watter. 9BAK says he will have a 100 watter going next month. 9DDA still using 20 watts. 9CTB sold his 5 watter. He has a 100 watter headed toward England now. 9AZX has been testing out the very short waves and testing with the Naval Station NFV.

"JK" OF 9RC CHICAGO IS A WAITER IN AN ALL NITE HASH HOUSE WHILE GG TO COLLEGE
?
HERE'S YOUR DX SOUP MISTER
8DAY SOUNDS LIKE A CLOCK (O. M. SPHERSON PARKSBURG W. VA.)
TICK
TICK
BUX

Traffic: 9BON, 224; 9EFZ, 138; 9DJZ, 43; 9DVK, 33; 9BKJ, 26; 9AFY, 25; 9DMI, 18; 9DLN, 14; 9AVB, 14; 9BPT, 13; 9DYT, 12; 9EM, 10; 9BMC, 10; 9AKO, 8; 9DRS, 4; 9BYI, 2; 9BUJ, 2; 9BQN, 1; 9DHJ, 41.

SOUTHERN INDIANA—Mr. White of NKF called on the Indianapolis Club Aug. 11th and enlightened the gang on the activities of the Navy on short wave work. 9ARP blew all four of his 5 watters. 9UR is selling out and says that he is quitting the game. 9CZS is rebuilding for 100 watts. 9VC has just been appointed C.M. of Indianapolis. 9BVZ has been doing some work on 70 meters but hasn't anything startling to report yet. No other stations have been reported as working on short waves in the south end of the state. 9CBA is putting in 10 watts. 9BUJ has just put in a new antenna. 9AMT will be on all winter at Fountain City. 9AXH just put up 60 feet of rain pipe mast. 9EJI put up 50 feet. 9DUC lost his 82 footer.

Traffic: 9BJL, 25; 9ES, 21; 9EJI, 19; 9BCC, 14; 9CSG, 11; 9CUR, 10; 9BVZ, 8; 9EQU, 1.

MICHIGAN—Many Michigan stations are getting down on 80 meters but the 40-43 meter wave is not being worked much at this time. 8ZZ of Detroit has worked 1XW at Hartford several times in daylight. Short waves are proving beneficial

SOME MORE OF THE MADISON PICNIC BUNCH
Left to Right, Standing; 9DCV, 9ATU, 9EAR, 9DCT, 9DRO, 9CZE, 9CTA, Sitting; 9BPQ, 9ACM, 9EMD, 9ADP, 9CFD, 9CWP, 9DTK.

in clearing traffic in daylight as good distances are being reported.

Dist. No. 1: Report almost nil this time, vacation and the old story of cleaning up the "shack" is the excuse. Many are reporting even tho no messages—they report changing the set.

Dist. No. 2: 8DEP leads the district this month. 8CFQ has moved from Lake Odessa to Fremont which puts him in district No. 3. This is a fine

place for a good station. The D.S. expects to be going on 80 meters as soon as he gets back from his vacation.

Traffic: 8DEP, 19; 8DFB, 18; 8DOO, 16; 8DCW, 12; 8CLG, 11; 8CEP, 11; 8DIL, 10; 8BDR, 9; 8DBO, 7; 8ZZ, 7; 8ZF, 6; 8DAT, 4; 8AMS,4; 8BUL, 3.

DAKOTA DIVISION
D. C. Wallace, Mgr.

NORTH DAKOTA—Amateur activities during the past month have again been seriously curtailed due to several lightning storms. 9AEJ, 9AMP and 9CSI are on every noon from 12.30 to 1 p.m. 9EIE is a new man but expects to handle quite a few this winter. 9CRG will soon be on the air again. 9DNX is now located at St. Paul. His next call will be a six. Would like to hear from the gang. 9UH is rebuilding his rectifier. 9DKB expects to be on with a couple of fivers. One station has reopened and several new ones are being developed to apply for ORS certificates. This state has always had a small number of stations but is now rapidly coming to the front with at least three new sets in operation. All traffic in this state handled during noon hour.

Traffic: 9AEJ, 13; 9AMP, 12; 9CSI, 21; 9EIE, 1.

MINNESOTA—9MB has been off the air lately, except for scattered moments at the key. 9CMS had the hard luck to have a telephone pole fall down with him and has been laid up. Will put in 100 watts. 9BFU is also rebuilding. 9ASF is installing S tubes. 9BAB is trying to get a set going again. 9MF is doing very good work, connecting up with both coasts in bad QRN. 9EIQ uses 10 watts on 80 meters and 100 on 150-200 meters. 9BNF is also doing good work. 9AWN and 9BJZ are coming back on the air soon, the former with 250 watts. 9CMM is breaking out with pure d.c. on plates of 5 watters. The SMRA convention to be held at Sleepy Eye will be a humdinger from all indications. 9DQM is getting set for real low waves.

Dist. No. 3: Things are picking up fine here and everyone is getting set for short wave work. 9HM is back on the air, as is 9AXX. 9DYZ is putting up a new antenna. 9DAW is undergoing rebuilding for winter DX. 9ZG has "bettered" his antenna and now it doesn't work at all. Hi! 9ZT-9XAX have a new call-9TT. 9BDQ has them all beat. Has blown to date five 5 watters, two 50 watters, four meters, 2 transformers, 2 masts and three ctpses.

Traffic: 9DSW, 8; 9CMM, 2; 9DJW, 7; 9BTZ, 3; 9MF, 41; 9BYY, 5; 9CMS, 3; 9DMA, 6; 9MB, 1; 9CPO, 9; 9BQY, 27; 9DPX, 18; 9BPY, 8; 9BNX, 9; 9CIP, 27; 9ZG, 12; 9DFZ, 20; 9DGE, 61; 9BIK, 28; 9BIS, 47; 9ZT-9XAX, 75; 9BFI, 53.

DELTA DIVISION
W. W. Rodgers, Mgr.

MISSISSIPPI—5ALZ came in this month in first place. 5QZ found his old spark set a very useful addition to his station, when his C.W. blew up and fell back on the old reliable spark set for good work. 5KR has been testing with high powers for the season. 5NJ reaches out well but handles no traffic. 5AKP has an unlucky number of messages—13.

Traffic: 5ALZ, 135; 5QZ, 83; 5KR, 19; 5AKP, 13.

LOUISIANA—No traffic is going through this state, at least no messages have been reported. (I don't believe it is possible for hams to work DX without handling some traffic—D.M.) 5LH, 5NJ, 5UK, 5OO, 5QJ and 5GI report good work, but nothing heard regarding traffic. 5RH was a visitor to the Delta Convention. 5ZK and 5RH are rebuilding.

TENNESSEE—This state shows up well this month, in spite of the fact that the Memphis gang was busy with the convention work. 5KA came out of the struggle heading the Tennessee list. A 50 watt tube and a 450 watt Thordarson Transformer won at the convention will make 5KA a better station this winter. 5CN at Bemis was lucky at the convention carrying away a whole raft of prizes. (FB, OM—D.M.) 5AMF reports fierce QRN. 5AIY was forced to let up in his race for traffic honors when his lone tube went west. 5APC has a mighty good total this month. 5WO reports 25 long messages. 5AMF has two ops and his traffic shows 45 messages handled. 5AOT and 5AIK are operating, but nothing doing with them on traffic.

Traffic: 5KA, 83; 5APC, 72; 5AMF, 45; 5AWO, 25; 5AIY, 20; 5CN, 6.

ARKANSAS—A new station has reported this month. 5WW at Conway sends in a very nice report and we thank him for it. Two UV-201 tubes with 500 volts on the plates handle his traffic for him. 5QH, another Arkansas ham, reports 26 messages. 5SN and 5BI say "nothing doing." 5XAB-AW reported in person at the convention.

Traffic: 5XAB-AW, 36; 5QH, 26; 5WW, 25.

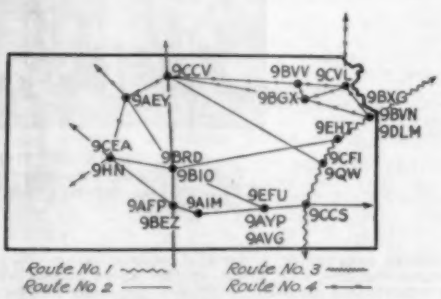
MIDWEST DIVISION
P. H. Quinby, Mgr.

NEBRASKA—Dist. No. 1: The Citizens Radio Club of Omaha held its annual banquet August 9th. About 50 were present and among them were Hams from Kansas, Missouri and the Nebraska bunch. L. B. Laizure, the newly elected director for the Midwest Division was present and gave a very interesting talk on what took place at the recent directors' meeting at Hartford. Contests were held and prizes awarded winners. After the banquet, visiting members were taken to stations which were in operation for a night of brass pounding. New ORS's in this district are 9CIM and 9HG. Traffic has been very light this month, most stations closed for rebuilding. 9AWS and 9BNU seem to be the most consistent. 9BNU is the star for this month, having handled 61 messages. 9AWS reports hearing WNP. 9AQO will be on the air soon. A great deal of enthusiasm has been aroused by the new short waves and the entire gang has started reconstructing.

Dist. No. 2: 9AKS has been appointed D.S. to succeed 9DNC who resigned. Quite a number of stations are on this district, and a fair amount of traffic was handled. New ORS's are: 9DJP, 9AFR, 9CGQ, and 9RB.

Traffic: 9AWS, 41; 9BNU, 61; 9EB, 13; 9AFR, 18; 9RB, 20; 9AKS, 8; 9DJP, 2.

KANSAS—9CCS has been appointed to succeed 9DTA as ADM for Kansas. There is a new DS for southern Kansas, 9BIO. 9BGX gets a card from Z3CA. 9BGX only uses two five watters. 9DNG



THE PERFECT WORKING KANSAS ROUTES

did some real DX by working JUPU when that statoin was 50 miles off the west coast. He used a new 203A to do this good work. 9BIO and 9BRD have been QSRing west 9EFU is punching the

QRN in fine shape. 9CCS is moving into his attic and fixing up for the winter. The gang are highly satisfied with the new wave lengths and several are working down on 80 meters already. 9CFI is one of these. He is doing fine work. 9EHT is getting the Lawrence gang lined up and reports several new stations for the winter.

Traffic: 9HN, 16; 9IW, 12; 9QW, 20; 9CFI, 30; 9EHT, 10; 9DNG, 103; 9BVV, 42; 9BXG, 38; 9BVN, 61; 9CCS, 50; 9BIO, 96; 9BRD, 32; 9EFU, 23.

IOWA—In general, traffic has picked up a little during the past month but is not where it should be yet. CM 9AHH reports that there will be 7 stations to handle tfc in his city this winter. 9CTD uses the following routes: EAST—9DYY,

9BOG
SOUNDS MUDDY, HUH?
(G.A. CASE, DES MOINES, IOWA)
BUX
9FV WORKS IN A CASKET FACTORY
I'LL USE THIS ONE TO BURY MY BURNT OUT SO WATTER
BUX

South—9BPF, West—9CZP, North—9DXC. OBGH has been reappointed RM for Iowa. All ORS are requested to get lined up with him for routings of msgs. Also stations desiring appointments as ORS are requested to write the DS or ADM regarding same. 9DKY resigned as DS of Western Iowa. 9BRS, 9AYE, 9CAV have applied for ORS appointments.

Traffic: 9DSL, 37; 9BCX, 100; 9DJA, 2; 9CS, 10; 9CWF, 84; 9CZO, 21; 9AHH, 2; 9CTD, 103; Other stations—9DXC, 201; 9DMS, 44; 9CGY, 54; 9AED, 21; 9CSY, 12.

MISSOURI—Activities at all stations were practically nil because of very unfavorable weather conditions. Very few stations are taking advantage of the new "regs" 9CCW and 9ZK being the only ones to work regularly every night. 9BLG is the proud possessor of a card from 9CBG. We are sorry to hear that 9CCW will be off for a period of four years. 9AAU-ZK are planning to do some consistent work this year. 9DWK, 9BDS, and 9BSH are busy developing apparatus.

9CKS is absent at summer school but will be back with 50 watts shortly. 9DIX is working short waves, getting NFK and 8XS in good style. He has a pair of 80 foot towers. 9CHE (ex-9EX) tried 80 meters but ND and went back to 150. 9DZL is a new station but is silent now while DZL is touring in the west. 9CUA is overhauling. 9ADC had to quit operating so much and is driving an oil truck. 9BVK is a new OW in Sedalia and is coming on with 20 watts. 9DZO keeps up with 5 watts ACCW. 9DAE still working spark the spark coil and relaying the msgs in daylight. 9EBV left for the north to see 9ZT and get the secret of how to make a tube eat soup. 9DMT moved to Chicago. 9DEU is about ready to work relay tfc. 9ST still holds the lead in KC with msgs but say someone else will get it now that he leaves for school. New ORS's are: 9BRU, 9AHZ, 9DIX, 9EAO, 9ACX, 9BKO, New special licensed stations 9DJB drew 9ZB—9SS gets 9ZD.

Traffic: 9EBV, 81; 9EAO, 31; 9CHE, 18; 9DLH, 42; 9CYK, 11; 9DZL, 6; 9DAE, 29; 9BUC, 5; 9CDO, 12; 9ST, 267; 9ADR, 25; 9BKO, 12; 9AHZ, 16; 9DJB-9ZB, 2; 9SS-9ZD, 2; 9DRR, 30; 9ACX, 2; 9RR, 1; 9AAU, 43; 9BLG, 42; 9DXN, 12; 9DMJ, 11; 9CCW, 10; 9DWK, 4.

NEW ENGLAND DIVISION
I. Vermilya, Mgr.

MAINE—1AUC, 1AUR and 1PD are getting out on 78 and 80 meters. 1CJR has been visiting our state this month on board the schooner "Sunshine," working 100 miles daylite with one 201-A with a Ford coil on the plate, radiating 0.3 amp. 1GA is moving to Roslindale, Mass. September schedules: f8RO 100-150 meters; 2000-2100; 2200-2300; 0800-0900, G.M.T. f8AU 85-200 meters; 0400 and 2300, G.M.T. 1KX, Dick Chase of West Beldwin, became the A.D.M. of Maine September 1. Mr. Hilton, former A.D.M., is entering Massachusetts Institute of Tech.

VERMONT—The convention pulled by the Poultney gang was a success—more about it elsewhere in this issue.

The stations for the most part have started in getting ready for winter. 1APU is putting in one k.w. of C.W. and will probably make himself heard in the near future. Delivery has remained good although traffic has slumped a little.

Thanks to Mr. Hebert at the convention, most of the waves are going down. There are two new O.R.S.'s; 1CQM, and 1AEY.

WESTERN MASSACHUSETTS—There is very little to report in the way of activity. Most stations are rebuilding and overhauling in preparing for fall. Worcester county as usual has the largest number of stations operating. Springfield also has a few stations going. The new A.D.M., T. F. Cushing, 1AWW, ought to get things started in another month and things should pick up with this change of "party." I sincerely hope that the district will give Mr. Cushing their entire support. 1BCR now operating under the calls 1RF and 1AHW worked Porto Rico on Aug. 15th and his signals were reported the loudest short wave sigs. the Porto Ricans had ever heard.

We have Miss Daniels to thank for the Western Mass. report this month. She turns in a very good report and we take this opportunity to extend thanks of the gang to her. All stations please report to the new A.D.M., 1AWW.

EASTERN MASSACHUSETTS—Things seem to be a little more lively this month although they aren't what they ought to be. Glad to say traffic is quite a little more than last month, 314 msgs being the total and more stations reporting. As usual 1AAC-ZD seems to be doing the most noteworthy work. Says traffic isn't so very easy to get but is doing some fine work on 75 meters. He is successfully working 2's, 3's, and 8's with an input of about 50 watts, at noon. This surely shows that the new waves are going to open up a new field of experimentation. He is also working 4SA in Porto Rico. 1AQI reports new 75' mast and hopes to boost traffic next month. 1DY, D.S. is going to make an awful start to get on again as the bug is itching again. Several stations have failed to report for over three months in his district, so there are going to be some cancellations of O.R.S. 1AFS of Marblehead got away with 57 this month but complains that traffic north is very hard to get off. 1AQY still on a vacation. Our YL. station, that of 1KY, is handling quite a bit of traffic and is on consistently. QRM and QRN seem to mean nothing to her. 1AIR has just got a new set perkin' which he reports is getting out in fine shape, using three 5 watters and coil Meissner. 1BZQ says that due to trouble with his lightning switches grounding the aerial and counterpoise, he has not been able to maintain any schedules and less DX than usual. 1LM says things still moving rather slow but he is hitting N.H. better this month. 1ZW-EX is out of commission until September. 1RH is experimenting on 75-80 meters and hopes to do some fine DX there shortly. 1ALL has been operating more or less spasmodically this past summer but has been doing good work when they were on. 1SE, C.M., reports that things are pretty slow just now, but things are beginning to show signs of life.

RHODE ISLAND—As usual 1AID sends us a peach of a report. She sure is a fine girl and R.I. hams are proud of her. Heat and vacations knocked radio out this month but as a number of new stations are opening, guess this winter will see R.I. near the top of the list. 1CAB has put a 60 foot stick and will be on this week. 1PM and 1OJ will be going soon due to the untiring efforts of our C.M., 1OW. Here is a real C.M.—wish we had more like him in the game. An old station with the new call is 1WE, heard of late. 1AWE boasts of a new tuner and will have a 50-watter and a new mast soon. The following stations have been logged by 1II in Europe using one tube and an indoor aerial 45 feet long. Heard while in France 1OW, 1ABF, 1CMX and 2PD. Heard while in Switzerland, 1SF and 1BGQ. A new station has opened up in Westerly under the call 1QV. He uses a 50 watter and although he has been on only a week has worked a Canadian. He is a good op and that is what we need. 1AAP has been on a little more than usual but says traffic is light. We find it so every where I guess. 1BVB has been conducting tests with Mr. Henry Joy of Watch Hill for the past week. Mr. Joy has a power-

ful fone set at his house and another on his yacht "Spray III." We have been doing a lot of testing with the yacht. Mr. Joy's house station call is 1AHM and the station on the yacht is KFKW.

CONNECTICUT—The message reports still continue to be low but activities are on the increase. Due to short waves and no quiet hours, more stations are getting back on the air and daylight DX is in vogue. 1CTI, 1AEA and 1AOS are in line for O.R.S. certificates and should make good stations. 1XAM, 1XAQ, 1XW, 1IV, 1AVJ and 1MY can be

HE NO DOUBT FIXES
GRID LEAKS AND
OTHER KINDS OF LEAKS

heard between 75 and 80 meters regularly and working threes and eights at noon is easy. 1XAQ is experimenting on short waves and will have a transmitter going soon on 5 meters.
Traffic: 1ALK, 14; 1AUC, 5; 1AUR, 15; 1BCY, 31; 1BHR, 10; 1BTT, 6; 1CJR, 187; 1GA, 10; 1PD, 16; 1VF, 18; 1FN, 7; 1CQM, 26; 1BDX, 24; 1AJG, 12; 1PY, 28; 1ABF, 64; 1AWW, 45; 1IL, 15; 1ARE, 11; 1AGT, 35; 1AAL, 6; 1ASU, 32; 1AKZ, 9; 1AJK, 51; 1BQK, 8; 1DB, 12; 1AFA, 12; 1MM, 9; 1RF, 9; 1BVR, 7; 1AIR, 4; 1BHP, 20; 1KY, 32; 1RH, 18; 1BDU, 14; 1AFS, 57; 1BZQ, 21; 1UM, 23; 1SE, 5; 1AHL, 3; 1NT, 2; 1RR, 42; 1ALL, 15; 1CEA, 6; 1AQI, 17; 1AAC-ZD, 35; 1CKP, 10; 1KV, 40; 1AWY, 14; 1AH, 6; 1BJG, 16; 1AVJ, 5; 1AOS, 28; 1AEA, 11; 1CTI, 2; 1ADB, 25; 1BM, 2; 1AEG, 20; 1AJT, 18; 1BGC, 7; 1MY, 44; 1XW, 9; 1AEL, 21; 1AWV, 11; B1IE, 13; 1BCC, 32; 1ANH, 21; 1GV, 19; 1OW, 26; 1AID, 68; 1AAP, 26; 1QV, 6; 1BVB, 58.

NORTHWESTERN DIVISION
Glenn E. West, Mgr.

Traffic activity in this division is at a rather low ebb just now. This is due to the fact that almost every station that would normally be on the air is now rebuilding in order to get down to the short waves. The fact that traffic figures are low and reports scattering, is proof that everybody is making a supreme effort to get down on those short waves. Quiet always precedes a storm and we predict that it will be a regular cloud burst by the end of the next month.

IDAHO—Things are not doing quite as good as they were last month but it is due to the extremely hot weather and the many vacations. 7OT just returned from the east and reports that he had a wonderful time while back in Hartford. 7OB is still going regular and is helping the YL of 7SI build her set. 7SI has been on a vacation in Canada for several weeks. 7ACF and 7GW were issued O.R.S. certificates and 7GW is enlarging his set to 10 watts. 7GX has a 78' tower to help him get out this winter. 7IU was in Salt Lake but came home with a wave meter and chopped about 20 meters off his wavelength. 7AHS is going good but having a hard time getting through static. We haven't heard from 7KC lately. 7IO is all rigged up for the cooler season with 20 watts and a crate of cigarettes. 7LN has resigned the task of A.D.M. because he has to leave for school soon. You will hear him signing a 9 before long. 7IU is moving to Moscow and will be there through the winter. 7QP in Northern Idaho is heard quite often.
Traffic: 7LN, 18.

OREGON—In the past month new O.R.S. certificates have been issued to 7EM, 7SY, 7QT and 7TO. 7AV and 7CW are on every night and 7AKK seems to be able to work nines right through the summer without any trouble. 7GK, 7AKK and 7AIX handled the most messages for the month, respectively. 7LS and 7GU have fifties pounding out good and are going down on the short waves. 7UN is the only station on regularly in Eugene besides 7IW who is just on occasionally. The greatest activity in the district is the rebuilding of the sets for the short wave bands. Everyone is rarin' to go on these low waves.
Traffic: 7RW, 21; 7MF, 8; 7LS, 3; 7FR-7ACM, 11; 7HH, 4; 7TQ, 8; 7AV, 64; 7GV, 56; 7AKK, 52; 7AEK, 25; 7RD, 15; 7AKT, 8; 7IW, 14; 7AIX, 26; 7AKH, 1.

WASHINGTON—Dist. No. 6: Most of the gang are still at it. 7GR and BJ handled considerable traffic with 7QS up in Bristol Bay, Alaska. Traffic handling to the east is at its lowest tide of the summer season now and next month things will start with all hands. 7VN in Kalama is improving his station. The Vancouver gang are also making use of 80 meters and good results are obtained.
Traffic: 7GR, 48; 7BJ, 48.

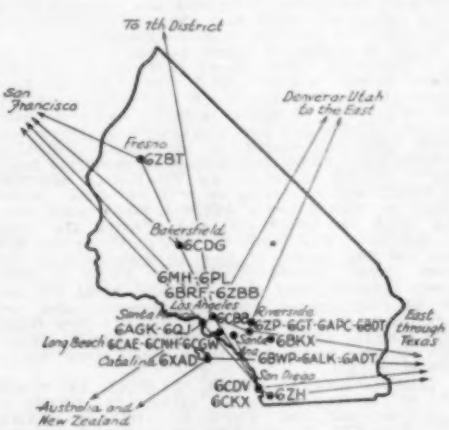
ALASKA—7QS, ham station at Naknek, Bristol Bay, Alaska, some 1800 miles from where the Northwest hams are located, succeeded in working several Aberdeen, Vancouver and Chehalis stations in Washington, and also some in Portland, Ore. He used 500 cycle soup on the plates of a couple of fivers and had a separate small ham antenna. Several hundred words in ham traffic went over the set to the states. 7MJ in Ketchikan worked him also. Most of the ops will be back in the states and the coming winter will be almost hamless up there except for 7AHB at Anchorage.

MONTANA—Nearly all of the Montana hams have been rebuilding or vacationing during the past month. 7CO's first and second ops were up in the mountains for a month. They are back on the job now and going strong on 150 meters. 7ACI has been experimenting with the short waves. 7IT is heard occasionally. 7APP is a new-comer among us. His QRA is Mr. M. W. Buening, Red Lodge, Mont. 7ZL has been away from home all month but he took his Low-Loss with him. He logged a lot of short wave staitons, 7ZU has been up in the mountains on a fishing trip.

PACIFIC DIVISION
M. E. McCreery, Mgr.

Organization has been proceeding rapidly in the Pacific Division. The California districts are very nearly organized, quite a number of O.R.S. appointments having been made together with such personnel appointments as were necessary to carry on the work. It is gratifying indeed to note the progress that is being made, and the interest that is being shown by members of the Pacific Division.

CALIFORNIA—Traffic has been moving in nearly all directions in spite of summer weather. Eastbound traffic moves best either through Denver, Utah, or Texas. Texas is the most consistent re-



SOUTHERN CALIFORNIA TRAFFIC ROUTES

lay point. Communication with Hawaii has been nil, and no traffic at all to the Island. Westbound traffic for either Australia or New Zealand has been broadcast and most of it has reached its destination. DX weather has improved the latter part of the month.

Dist. No. 1: 6ZH has handled no traffic due to bad luck with his antenna system. He has a new one now which is better than ever. 6CHX is get-

ting out better and handles San Diego's share of traffic. 6CDV blew his 50 after three weeks use and was forced to QRT which caused his minimum of messages. 6ZH is reconstructing his apparatus. 6BWP is rebuilding also. Traffic moves through Fullerton with ease. 6ADT is the high point man in the district and handles traffic north and southeast very easily. 6ALK hasn't been on much due to summer weather, but he manages to take Fullerton's share of msgs.

Dist. No. 1A: No report from this district.

Dist. No. 2: 6ALF is the new superintendent for district No. 2. Plenty of good stations are moving traffic in fast time. 6BRF managed to get his heap working again and clears his hook with ease. 6MH came on with a 50 watt tube in the month and handled a few msgs. 6ZBB shot 2 fifties and was forced to QRT, although they did last most of the month. 6AFG steps out good and don't let msgs. lag around at his station. He is a good one to give LA city traffic to. 6BEG raised a new stick and was on the last of the month. 6AAO was on a vacation so did not make much noise during the month. He will be on next month QRV for QTC. 6PL has been very busy trying to organize Southern California. He forwarded a few msgs. to New Zealand and Australia by broadcasting them. 6CMU is using 100 watts now and is a good relay station for LA city traffic, and northern msgs. 6BH is rebuilding his transmitter. 6RN is rebuilding, which caused the small msgs. report. 6BLS, a new station, is doing good work and has cleared his hook regularly. 6BBQ will be a good relay station for Pasadena next season. Traffic has been moving slowly through Santa Monica. 6AGK and 6QJ take most of the traffic. 6AGK is rebuilding. Three reliable stations in Long Beach for QST are 6CNH, 6CAE and 6CGW. 6BRC has been worked by 6CAE with an amplifier tube and traffic handled. 6CGW is installing bunks in his shack so that the visiting operators may have a place to turn in. Hi! He handles traffic in almost any direction. 6CNH finally raised a 55 footer after having it break on him about two or three times. 6ZP is a new C.M. and deserves credit for his first report and all the dope he gathered up. 6BKK expects to be on with a 50 watter soon and will be a good station for San Bernardino traffic. Reliable stations for Riverside traffic are 6ZP, 6IV, 6GT, 6APC, 6BDT. 6APC handles eastern traffic easily. He has been heard in New Zealand three times. 6BDT, with a lone 5 watter has been heard almost everywhere and handles his share of Riverside traffic. 6GT is rebuilding for winter. 6ZP is dismantled due to moving his QRA.

Three chances will be given an O.R.S. to report and after that his certificate will be cancelled if he does not report. There are plenty of fellows that want to become Official Relay Stations, so wake up fellows!

Dist. No. 3: 6CBB steps out fine and always clears his hook in fine shape. 6CDG, has been appointed D.S. of district No. 3, and he is organizing as fast as he can. 6ZBT has been appointed C.M. of Fresno. He relays traffic in all directions and is the only station there at present that reaches out and can be relied upon for QSR. 6CDG is a good QSR station for all directions. Stations in this territory are far apart and very scarce. For this reason, some reliable stations are needed in this district. 6CDG and 6ZBT are the only ones holding O.R.S. certificates here at present.

Well fellows, it sure looks as if district 4, 5, and 6, are at last coming out of their long sleep from the number of reports that have come in for this month. The A.D.M. and D.M. appreciate the showing made by the newly appointed C.M.'s and D.S's. Keep it up fellows because there is no reason now, with the D.M. we have backing us, why the Pacific division should not come to the front and be one of the best traffic divisions. O.R.S's are lacking in these districts.

Organizing a practically un-organized territory has been slow and tedious work, but we hope to have districts No. 4, 5, and 6 organized as to C.M's and D.S's very soon. Fellows wishing O.R.S. appointments should write to their C.M., D.S. or A.D.M., and they will receive immediate attention. Several inquiries have been received already and application blanks have been forwarded. (Come on fellows, we need Official Relay Stations, so please let us hear from you—A.D.M.)

Articles are being published in the Oakland and San Francisco papers relative to A.R.R.L. activities, so if you fellows will look in the Sunday Radio section of the various papers you can keep track of what is going on in your district.

Get your report into your C.M. so he can get it to the D.S. in time to reach the A.D.M. by the FIRST and not later than the SECOND, as the D.M. must have it in Los Angeles by the FIFTH, or it won't get back to QST in time to be published. Any A.R.R.L. member wishing information regarding League matters should write to the C.M. who has charge of your city, or the D.S. who is in charge of the district, or the A.D.M. who is in charge of that part of the state.

Dist. No. 4: 6NX has been off the air a good deal this summer but is going again with a 100 watter on 150 meters?? 6BON, 6HC, 6ANH, 6APS, 6AHZ, 6AGJ, and 6CJK are on at rare intervals now.

Dist. No. 5: There has not been much doing in San Francisco this month, due to too much QRM from bum fone sets that come on after 10:30 P.M. 6CMM is just back from his vacation. 6CSL is a new comer on the air. 6BL will have

WAH
HEY KEEP STILL — SOMEBODY'S CALLING ME NOW !
6OX-6BDY
BETWEEN WALKING THE FLOOR WITH A NEW "JUNIOR OP" AND POUNDING BRASS— GZN NEVER GETS ANY SLEEP

a 100 watter perking soon. 6JP has almost finished his 50 watter. 6MF is off the air at present. 6RY reports DX, FB, on 10 watts, using 500 volts storage batts. 6CPW's drain pipe mast came down. 6BQL has some funny noises in his transmitter and can't find 'em. Hi! 6HJ, the ivory tickler at the Pan, says he's going to have 100 watts soon. 6BUE handles traffic on his portable call 6BMS. 6CEC has been busy printing "calls heard" cards. 6RW has a new shack and will be using 100 watts storage batter juice. 6AWT just returned from a vacation, and will have his 250 watter going soon.

Dist. No. 6: 6IP is hooking up a MO-PA set with 300 watts. 6NH and 6RU are getting ready for winter. 6ZX has both transmitter and receiver dismantled, getting ready for those bands. 6AFZ is helping IP get on the air. 6ALX is using both C.W. and Spark. 6AMO is one of the star stations handling traffic. 6LV has him beat about 63. (Congratulations, fellows, FB!) 6ATZ, a new O.R.S., hams around with fone. 6AVH is getting out fair with six watts in the antenna. 6BAB is doing fine work with 10 watts. 6BIP is operating 6TI during TI's absence, using four coil Meissner. 6CAX is doing fine work with W.E. 50 watter. 6CGL awaits a job pounding brass on the high seas. 6CTT is a new comer with a 5 watter and is doing fine work. 6AFA is coming on soon with high power. He won't tell how high. 6CEE has just returned from a vacation. 6AOR-ORW-qt college for work at present. 6AOP, 6BQI, 6ASI, expect to be back soon. 6ASN shows a good total on spark—better put in C.W. and run that total higher. 6BUY, 6CEJ and 6ARB are too busy courting. 5DO has just purchased a couple of "S" tubes and hopes to step out with their help soon. He also holds the DX record around here for summer, having worked 4570 miles WEST of San Francisco. (FB, OM) 6BCU busy building a Low-loss tuner and getting ready for a 50 watter. He is using Meissner circuit. 6EW chews the rag sometimes on fone. Meissner circuit seems rather popular in Richmond, Cal. as three stations are using it and report FB. 6HP is using a three coil Meissner and getting lots of kick out of it on 150. Also has a calibrated oscillator like the one described in QST and says it sure is FB. 6AGN is now on regularly and will provide a good route to Sacramento.

Well fellows, the A.D.M. is more than pleased

with this report and it wasn't much effort, was it? Keep the good work up, gang!

No report from district No. 7 and 8 this month, but it is hardly to be expected and the A.D.M. is still in the embryo state of organization. Next month, however, a good report is expected from these two districts.

ARIZONA—6FF, old 6ZZ, is about to be persuaded to handle Arizona again. By next month it is hoped that we will have a report from Arizona.

HAWAIIAN ISLANDS—The gang is getting ready for the new DX season and a lot of new stations are hitting the air. At the present time, 6ANY and 6ADO are the only stations QSO with the mainland. Hams here are in hopes that they will be able to QSO New Zealand, and a series of tests for September and October have been arranged with 4AA of New Zealand.

Traffic: 6CGW, 20; 6CAE, 22; 6CNH, 12; 6AGK, 7; 6QJ, 2; 6RN, 4; 6BLS, 16; 6BBQ, 24; 6ZBB, 30; 6BRF, 21; 6AFG, 49; 6ZBT, 10; 6CDV, 9; 6CHX, 9; 6VL, 15; 6ADT, 30; 6ALK, 9; 6CDV, 1; 6PL, 105; 6CBB, 31; 6ZX, 10; 6AFZ, 5; 6ALX, 6; 6AMO, 100; 6ATZ, 15; 6AVH, 3; 6BAB, 15; 6BIP, 47; 6BMV, 35; 6CAX, 10; 6CCT, 7; 6CGL, 10; 6CLB, 40; 6CTT, 6; 6CDP, 5; 6AJF, 22; 6ASN, 85; 6BFU, 10; 6CKC, 16; 6HP, 17; 6CHL, 60; 6AWT, 58; 6CMM, 28; 6BL, 2; 6JP, 1; 6RY, 34; 6CSL, 1; 6CPW, 5; 6BQL, 4; 6HJ, 14; 6BUF, 26; 6MF, 2; 6CEC, 1; 6CHE, 15; 6ADM, 10; 6RW, 9; 6AUU, 8; 6CLV, 30; 6LV, 163; 6CTE, 64; 6AMM, 19; 6NX, 3.

ROANOKE DIVISION
W. T. Gravely, Mgr.

Fellows, here is a list of your O.R.S.'s as they now exist. These are the ones who have made application for the certificates and to whom certificates have been issued. A division map is now being made by 3CKK, division route manager, showing location of these stations and the method of routing traffic both in and out of the division. Your manager will gladly issue certificates to members of the League who make application on the forms provided, and who will comply with the conditions: West Virginia —8AUE, 8BBM, 8CFX, 8DES, 8BTD, 8WZ, 8AFD, 8SP, 8BSU, 8AMD, 8ASE, and 8BLI. North Carolina—4BX, 4RW, 4JS, and 4UN. Virginia—3CA, 3BNE, 3CKL, 3BMN, 3CKK, 3ATB, 3DT, 3BHS, 3BKX, 3MK, 3TI, 3BBT, 3UU, 3CEL, 3BVL, 3BGS, 3AUU, and 3BZ. Now, fellows, you see who has measured up, and while the list is small, it represents the Official Relay Stations of the Roanoke Division at this writing. Does it satisfy you?

The gang are cleaning out on the 6 to 7 P.M. schedules now and we want more stations on the air at these hours. Everybody is preparing for the shorter waves in order to get on the air without the quiet hours. Loose coupled transmitters are being put in at all stations and we look for a big fall and winter.

WEST VIRGINIA—D.S. Bock reports great activity in West Virginia with loosely coupled transmitters and low waves. 8SP is trying out a transmitter on third harmonic and says it seems FB. 8AUE will try the same thing when he rebuilds. 8BLI has a new cage aerial, new transmitter completed, and is going to try out the 75 meter band with a four tube M.O., using one tube as Oscillator and three as amplifiers, "S" tube rectification, loose coupled circuit.

Traffic: 8SP, 12; 8DFM, 46; 8WZ, 7.

NORTH CAROLINA—D.S. Simpson sends in a small report. We should have a big report from that state as they are thick on the air and no reason why the reports should not be sent in to the D.S. in time to get the report in on time. (Wake up fellows, and let's show them some pep from this state!) 4UN is yelling for traffic—shoot it to him gang. 4JR seems to be right on the job, handled 41 and calling for more. 4BX is back on the air and is going to liven things up again. Raleigh is showing signs of life. W. A. Wynne is C.M. there and is putting in a 50 watt bottle. 4EA is putting in a 1500 watt MG.

Traffic: 4RU, 6; 4BX, 6.

VIRGINIA—3ATB is building a 10-watter now—remember he quit some time ago! Hi! 3SG will be on shortly at a new location. 3BCH is working on the code. 3MT is at a new location and using a 5 watter. 3ABS has his panel set going now, but is undecided about plate supply. 3CKN has quit flat—lack of interest. 3BMN has the only station at Petersburg that has withstood the barage of static the whole summer. 1400 volts on lone five watter, says all stations give him the QSR-QRV signal, messages bear the A.R.R.L. preamble or are not handled. 3AUU has 1000 Edison battery on his plates of the four coil Meissner and is getting down to 80 meters; also has a wave meter which is said to be the "berries" and uses a 1BIS tuner. 3BMN handled 62 messages. 3BVL has done some work at his station, still maintains the same old note, and is getting out FB, having worked up in to New Brunswick lately. He handled 42. 3CKK, our D.R.M. has just sent out a map of Virginia to all O.R.S. You fellows who have received this map QSL to 3CKK. This station handled 6 messages. 3BNE is going to sea. 3CKA handled 9 and 3TL 2. Very little activity in this section at present. 3BGS handled 5 messages using a lone 5 watter. 3FX is getting out on a 201-A with 60 volts B. battery. 3CFW on account of lack of power will be on with a low-powered set. 3BFE will be on this fall with a good transmitter. 3BZ has been logged in London, England. 3BKX has about finished his new transmitter and new receiver. 3BHS says every time he gets set for the hams something turns up and they change the waves making it hard for him to keep up with the gang. 3CKL is still doing consistent work with his set and handled 11. 3DT will be re-opened upon resumption of school work ot VPI.

ROCKY MOUNTAIN DIVISION
N. R. Hood, Mgr.

9CAA		87 Msgs.
	C.W.	
C. R. Stedman		Denver

COLORADO—Stations in Denver are all rebuilding their sets to the new wave regulations. Traffic has suffered terribly due to this procedure. The following changes in personnel and stations have taken place. New O.R.S. certificates have been issued to 9CPU. 9EAE has been appointed D.S. for district No. 2 take the place of M. O. Davis who was compelled to resign. The O.R.S. certificates of the following stations have been cancelled: 9APF, 9AVU, and 9BXM.

Dist. No. 1: Stations in this district have sent in small message reports due probably to the cause that has made all reports small this month, rebuilding.

Dist. No. 2: 100% report from this district. All stations working but traffic totals are small.

Traffic: 9FVO, 7; 9DTE, 9; 9CDE, 5; 9CLD, 11; 9CHT, 9; 9DFH, 3; 9AMF, 33; 9EAE, 14; 9CAA, 87; 9EEA, 1.

UTAH—The stations in Salt Lake have done wonderful work for this time of the year. Salt Lake is in what is known as a "dead spot," yet nearly every Salt Lake station has a foreign report to its credit. The following changes have been made in the personnel and O.R.S.'s in Utah. Even Seegmiller, D.S. for Dist. No. 2 has resigned. A new D.S. will be located as soon as the new A.D.M. is elected. A.D.M. Wilson has resigned and Art Johnson is acting AD.M. at present. O.R.S. certificates have been issued to 6CKI and 6FM. L. J. Haight has been appointed C.M. for Ogden. The state is undergoing entire re-organization and revision of the district boundaries, which we hope to report in full next month. A 000 K.C. Club has been organized in Salt Lake of which the members must all have 80 meter, or below 80 meter, sets, and obey the new regulations religiously.

Traffic: 6CRS, 13; 6RM, 54; 6AJA, 8; 6CJB, 10; 6FM, 7.

WYOMING—7AJT is the only station reporting this month and reports good results on 80 meters. A.D.M. Mitchell has resikned due to moving from the state. O.R.S. certificates for 7GK, 7ZV and A.D.M. Mitchell has resigned due to moving from the state. Wyoming will be in full operation in another month with its three O.R. A.R.R.L. stations.

SOUTHEASTERN DIVISION
H. L. Reid, Mgr.

GEORGIA—Traffic has suffered somewhat this month due to the excitement over short waves and most of the fellows trying to get their sets tuned to the lower wave lengths. 4IO reports that although he has been on only a short while during the month that he has a schedule with 6EGW on 40 meters. This opens up a direct route to the Pacific coast for transcontinental traffic. This station has also been in touch with Argentine CB8 (now DA8). From the reports received it appears that the new waves will undoubtedly speed up the handling of messages by allowing greater distances to be covered between relays. It also appears that reliable communication will be established with some of the foreign countries.

A number of the stations which have been off the air for the summer are starting up again.
Traffic: 4IO, 41; 4SI, 31.

ALABAMA—Alabama has taken on a very promising outlook. Several changes have been made in the Alabama personnel and very pleasing results obtained.

Station 5AR stands out for the month. 5AMH comes second with 5VV running a close third. Four new stations have been located and increased activity can be found over the entire state.

Dist. No. 1: Nearly all of the old timers have been heard from and several promising new stations have been located. 5ZAS has made some improvements on his antenna system and seems to be reaching from coast to coast. 5AX and 5MI have combined. 5AMH can still be considered the most consistent station. 5VV is now using 50 watts and is reaching out for new records. 5ACM will be ready soon with 50 watts. 5GP, 5BP and 5WB seem to be inactive. 5QP is about ready for business with a new 50 watter. A definite schedule with 5VV is planned. A promising station has been found in 5ARI of Tuscaloosa.

Dist. No. 2: This district has just been re-organized with Charles Rush, 855 Broad St., Mobile, Ala. as D.S. 5AR handled 110 messages for the month on 10 watts, with 1 K.W. spark set filling in the gaps. He is right on the Gulf Coast where old man QRN reigns supreme during the summer months. 5AGD and 5AOM are working regularly and helping to move traffic in the southern part of the state. 5QK and 5UT seem to be producing the goods and can be counted on for the coming season. Army life is occupying most of 5AC's time for the present. 5QF is working with 5AGD while his set is being overhauled. 5AGD promises to be among the first users of the short waves.

Dist. No. 3: Things are beginning to happen, especially in the vicinity of Montgomery. A. D. Trum, 5AJP, is now C.M. and at present is acting D.S. in the absence of D.S. Brooks. Promising material for several new "hams" has been found among B.C.L.'s. More power to you 5AJP—rope 'em in! 5AJP has just completed numerous improvements and is reaching out in good shape. 5ADA has just opened up and is beginning to handle traffic. 5AIT is off the air for a while remodeling his set. 5WI comes forward as the star station of the district. 5WI is using 50 watts and is handling traffic like a veteran through QRN and QRM. 5OS and 5ANE will soon be on the air.

Dist. No. 4: This district is still in a state of rest. 5XA, the chief station, will open early in September when school convenes for the winter.
Traffic: 5ADA, 4; 5AGD, 13; 5AJP, 28; 5AMH, 68; 5AOM, 19; 5AR, 110; 5MI, 10; 5VV, 61; 5WI, 36.

SOUTH CAROLINA—4PX-4SY leads the state with a margin in both the number of messages handled and DX, and worked into the sixth district ten times. Spartanburg is open to traffic through 4PV, 4IT and 4SH. All are doing excellent work. 4RR is experimenting with a coupled transmitter using an amplifier with 20 watts on the plate and has been reported twice at 200 miles. Old 4EG is on again with a 50 watter.
Traffic: 4PV, 73; 4SH, 1; 4IT, 21; 4EG, 3; 4RR, 41.

PORTO RICO—Conditions have been better this month and traffic has been pushed a little. With the arrival of 4SA on the air at Garrochales, a new link with the mainland has been established. A new station 4UR, has been set up at Cayey and 4KT is now back on the air at Carolina. Traffic with these inland towns is now possible.
Traffic: 4JE, 13; 4KT, 18; 4BJ, 9; 4RL, 2; 4OI, 5; 4UR, 2.

FLORIDA—Practically the entire gang is rebuilding for the short waves. Some stations are already using the new waves with great success, and we expect others to be ready soon. 4PK has acquired an experimental license and is now 4XI. 4DU and 4PI report fine results on 80 meters. 4SB has increased to a 50 and does better work. 4HZ reaches out with some regularity and keeps in good contact with Florida stations. The results of 4FS's experiments on short waves are very pronounced; viz—a blown 50. 4XE has returned from Maine and has been appointed C.M. of Orlando and Winter Park. He is going strong again and has been copied in France on a small loop and two "valves." 4IZ is away on a vacation, which leaves Tampa dead, and consequently part of the second district report is missing. 4QY stays on the job and is the most active in southern Fla. 4PB, 4BL and 4UA are on now and then and come through well.
Traffic: 4BL, 8; 4HZ, 8; 4QY, 7; 4PI, 2.

WEST GULF DIVISION
F. M. Corlett, Mgr.

Up to September 1, 35 O.R.S. appointments had been made under the new system and an equal number of the big new certificates issued to the stations qualifying. All old O.R.S. certificates bearing serial numbers from 1 to 102 have been cancelled. Those of you who have not sent in your old certificate for cancellation may do so, the certificate will be marked cancelled and returned to you.

64 stations report a total of 849 messages. Northern Texas 56 stations, 648 messages. Southern Texas 4 stations, 81 messages. Oklahoma 3 stations, 108 messages and New Mexico 1 station, 12 messages.

NEW MEXICO—5AMO reports that QRN is getting lighter.
Traffic: 5AMO, 11.

OKLAHOMA—5AQW is down on 80 meters. 5AGN is operating on 150 meters from 2 to 4 A. M. regularly. 5GA has just returned from his vacation and is rebuilding. 5ANF has been in National Guard Camp and has not had a chance to operate. 5JE is entirely out of operation. 5ZM

SAHD, ALTUS, OKLA. IS A FIREMAN

is rebuilding his transmitter into a Meissner combination of 20 and 50 watts, erectng a 90' antenna and will be on the air soon. Also will operate call of 5AFA nd 5XBD. 5APG hndled 20 messages.

All Oklahoma stations should get their reports into their A.D.M., 5ZM, 211 News Bldg., Enid, Okla. not later than the 25th of the month.
Traffic: 5AGN, 20; 5AQW, 68.

SOUTHERN TEXAS—Reports are very meagre due to stations rebuilding for the fall opening. Stations, please send your reports to the A.D.M. not later than the 25th of the month. 5AKZ is moving from Corpus to Waco. We congratulate Northern Texas on getting this excellent station. 5ADI is holding down the line in his section. 5BO is putting Western Texas on the map. He has a schedule with M-BX and has converted two BCL's —5AFG and 5ACP. 5FT is the only active station in Austing now. 5XAV is returning home to renew activity.
Traffic: 5ADI, 19; 5BO, 25; 5ADZ, 29; 5XAQ, 8.

NORTHERN TEXAS—Certificates have been issued to 5NW, 5UD, 5NY, 5QI, 5AHT, and 5EH. 5JF and 5CV have logged WHU. 5OQ has been reported by CB8. The popularity of low waves is spreading like wild fire. Practically every station in the section is preparing for work on the new 75 to 80 meter wave. Tuners and transmitters are being rebuilt. Several stations are already down and ready to work on the low waves.
Traffic: 5ACQ, 3; 5JH, 4; 5DW, 4; 5ANA, 35; 5NW, 28; 5NY, 2; 5LI, 11; 5JF, 18; 5AGH, 25; 5PH, 2; 5AAF, 3; 5ADH, 24; 5VU, 10; 5AMG, 4; 5ALJ, 4; 5AJT, 8; 5ADV-5TO, 27; 5UY, 24; 5FC, 51; 5QY, 3; 5UO, 75; 5AJH, 97; 5NS, 26; 5XAJ, 7; 5ALD, 11; 5OQ, 12; 5AKN,-5XBH, 25; 5HY, 4; 5RG, 29; 5AHT-5HW, 5; 5BD, 24; 5AGQ, 16; 5QW, 2; 5CW, 2; 5CV, 1; 5SD, 3.

CANADIAN SECTION
A. H. K. Russell, Can. Gen. Mgr.

Summer weather and its consequent holidays has played havoc with Canadian amateur activities, which have been at the lowest ebb for the past year. The sailing of V.D.M. pepped things up a little at the beginning of the month but to our great disappointment the Arctic has been out of range for short wave sets since the last

week in July although she has been in communication with the Louisberg station of the Marconi Company on 2100 meter set up to August 11th at which time she reported being 1700 miles north of Louisberg.

The advent of the short wave in the United States has caused a great desire on the part of Canadians for similar permission to use them and steps will be taken immediately with the view to having the Department authorize Canadian amateurs to use the waves under 100 meters.

Enthusiasm has been manifest in Canada and established in the west for the proposed all-Canadian convention to be held this fall. The Winnipeg division crowd have been approached and asked if they will handle this convention but so far without response from them and it may be necessary for the convention to be held in some other City if more enthusiasm for it is not shown there. The C.G.M. will be pleased to have letters from all Canadian amateurs who have suggestions to make concerning this proposed convention, such as the date and the place.

MARITIME DIVISION
W. C. Borrett, Mgr.

Radio activity in the Maritimes has suffered a slump this month. The storms that have visited this part of the country, having done considerable damage. Among the Halifax stations to suffer loss of aerials, poles, etc., were 1EF, 1EB, 1DJ, 1DQ and 1DD.

NEW BRUNSWICK—1EI is the leading Maritime station for the month, having handled 18 messages and has been reported in England. 1AF has also been reported in England and this should start a movement among N.B. hams to try and qualify for ROTAB's this fall. 1AB, 1AM and 1AN are working nowadays. 1DU has not been on much lately. 1BO of St. Andrews, N. B. is going strong. Through mistaken idea, this station was reported as being a "U" station in Canada for summer holidays. 1BO is a Canadian ham and is operated by Mr. Mason who promises much activity in future. 1DN is lost, stolen or strayed. 1EI reports that 1AI has returned, which is good news. New Brunswick has a splendid gang now. The A.D.M. for New Brunswick sent his report this month by radio. (FB, OM). All stations might try to follow his example as the gang seem to be suffering from writers cramp, generally. 1BZ A.D.M. for P.E.I. reports a new station in Summerside, P.E.I., which makes three for the Island. 1BZ is rebuilding his set and with 9AK should be on now. 1AW of Sydney is keeping tab on Cape Breton amateurs and any stations down that way should keep in touch with him and report their activities. 1BQ and 1EF of Halifax are making a tour of New England States by Auto. 1AR has been away from the game for a month. 1DD handled four mags. this month. 1DD will send the weekly QST on 75 meters on Saturday and Sunday nights, and would appreciate a call by radio immediately afterwards or a card from the Maritime gang getting the QST, to show how much it is received. 1DD will listen in after QST covering waves 75 to 80 and 125 to 175 so use any wave you like in calling.

ONTARIO DIVISION
C. H. Langford, Mgr.

General inactivity sum up the whole division as shown by the reports turned in. It is true there are some fellows plugging away the same as they always do and it is certainly a fine thing that the division has some of that type. Many have legitimate excuses for lack of work and vow that as soon as the holiday season is over better work than ever will be done. Many fellows are accumulating the needed parts for a real coupled transmitter for the coming season. Others are doing some fine summer DX receiving especially on the ultra short waves. It is hoped that the traffic slump will leave the district soon.

A regular ham outing was given on Toronto Island recently by A.D.M. 8BJ for his Central Division gang. A real time was had by all including inspection of stations and such matters as station schedules. Several of the Eastern Ont. gang have visited the Toronto fellows during the Exhibition there. 3IA is now C.M. of St. James.

And now we come to a part which will mean much to all the Western Ontario gang. Old time 3GN, more recently 9AR, has resigned from the position of A.D.M. for Western Ontario. Byerlay asks for leave of absence so we may expect him again. His resignation is regretted by the D.M. and it is hoped that his leave of absence will be short. For the present time the Western Ontario gang will please send all reports direct to the D.M.

Traffic: 3KQ, 24; 3OH, 21; 3FC, 22; 3WG, 4; 3BQ, 6, 3GK, 6; 3VH, 10; 3NI, 4; 3XN, 3; 3ACO, 23; 3OM, 4; 3IA, 25.

VANCOUVER DIVISION
A. J. Ober, Mgr.

ALBERTA—Alberta is well represented on the air each night, and traffic keeps moving in all directions. 4AX is back on with a 50 watter and has a great wallop. 4GT has now taken over the N. H. honors, he keeps his two 250 watters busy too. 4IO can be heard any night, and is a great traffic station 4CW has been at the coast on holidays, and had the pleasure of attending a "Ham" meeting there. We haven't heard from 4IC lately. Guess he's moving that hill back of his aerial. Hi. Mrs. 4DQ keeps traffic moving in great shape, and is often heard at the key at 3 A.M. 4AB says his total Loss tuner doesn't tune.

Traffic: 4DQ, 22; 4AX, 6.

EDMONTON—4AH has both poles down and transmitter in pieces. He will put in 10 watts soon. 4CL is taking his First Ticket at Vancouver and is expected home for a few days visit. His brother is returning from the north shortly and will put 4CL on the air again. 4JF the R.I. for Edmonton is working in Revelstoke, B.C. until Varsity starts here. G. R. Rice, the op at CJCA. intends installing a Marconi MT4, which thrives on 10,000 volt plate supply. Thermionic rectifier will be used. 4HF is pounding out with 50 watt A.C.C.W. 16 mags. were handled to date, the station being on the air about three weeks.

VANCOUVER—There have been more active stations on the air and more new-comers, this month than last month, and if interest keeps up at the present rate we will sure put this division in a class by itself. Vancouver has sure come to life, traffic moving in all directions and everybody happy. The West Coast gang are pulling a convention on September 20th and expect the time of their lives. They have been feeding the elephant "Wouff Hongs" for these initiations. Bill Rowan will gladly give you all the information required. The new D.S. for Edmonton is J. E. Sacker of 4HF. He has started things moving in great shape, and keeps that district QSO with his 50 watt station. Alberta is represented each night in great shape, but no reports of working VDM yet.

The gang are all primed for the big convention on Sept. 20th and wish to see as many outside "Hams" present as possible. 5GO takes the cake for traffic this month. 5GG continues to knock 'em dead with his 5 watter. 5HG and 5EF are both on regular and handle traffic. Other stations heard on the air are: 5AF, 5BF, 5HH, 5DS, 5HP, and 5BJ. 5BG is operating regularly.

VANCOUVER ISLAND—5CT reports traffic light. He is QSO Los Angeles regular but hard to QSO east and is building Low-Loss tuner also transmitter. 5SK has rebuilt his station with two 50 watters, but has not been on much.

Traffic: 5CT, 6; 5SK, 2.

PRINCE RUPERT—5CH comes through with word of trying to get things going again. (Tnx, OM —D.M)

WINNIPEG DIVISION
J. E. Brickett, Mgr.

Business is picking up. Most of the old timers are back at the key and many new C.W. notes are being heard through the division. Summer QRN is rapidly clearing away in this division, after slamming us harder than it has ever done before. East and west traffic routes are being re-established but the southern routes are very slow in breaking through. Prince Albert, Saskatoon and Buchannan are going to make the Northern Sask. route a sure thing, and "Dad" at 4CB, with that whale of an aerial

(Concluded on page XVI)

Calls Heard

IMPORTANT NOTICE

When preparing a list for QST, it is essential to observe the following rules:

1. List the calls neatly on a separate sheet of paper with a line of space between lines; do not embody them in a letter.

2. Arrange the calls as they will appear in *QST:* across the page numerically by districts, alphabetically in each district, Canadian and foreign calls listed separately, state whether spark or C.W., and give period of time covered by the list.

3. Forms close on the fifth of the month preceding the date of issue of *QST*. Make your lists cover the period from the first of the month to the first of the next if possible, but don't let your list come in late.

4. List only calls over 500 miles distant.

HEARD DURING AUGUST
unless otherwise specified

J. L. Menares, 8FJ
Le Blancat, Gan B.P. France.

1arf, 1bie, 1bzp, 1ccx, 1cmx, 1xae, 1xaq, 1xe, 2agd, 2exe, 2iu, 2kf, 2pd, 2rd, 2rb, 3ajd, 3bj, 2bta, 2cdk, 3cfk, 3chh, 3fc, 3ir, 3oh, 4ft. 4io, 4lx, 5ct, 8dnf, 8cyi, 8xs, 9cog, 9abf, 9zt, Receiver (O-V-1). Hrd 550 U.S. & Canadian st'ns to date. All cards answered.

R. T. Wright
2 Grove Park Terrace, Chiswick, London, W4.

1xam, 1xar, 1xah. 1xaw, 1xw, 1xz, 1xu, 1alw, 1bgf, 1ayf, 1ajk, 1vc, 1aac, 1aja, 1afn, 1aur, 1er, 2xib, 2bxd, 2xab, 3mb, 8awj, 8aji, 4xc.

Livio G. Moreira,
Curityba, Republic of Brazil.

Between May 19th and May 31st: CB8, fb (Uruguay), ub, (Rio de Janiero) caf, 1xz, 1xam, kdka, wgy, 8vo, 9zt, 1akf, 3hh.

Carlos Braggio, DA8, ex CB8
Bernal (near Buenos Aires) Argentina.

June 15th: 9amb, 3bay, 9blg, 9dby, 1avl, 2buy, 2tx, 3bnu.

C. N. Naylor, 5SI
43 Hill Crescent, Longden Road, Shrewsbury, Eng.

August 23rd: 1aur, 1beg, 2cu, 4sa.

W. G. Wilkinson, 4AR,
21 Melrose Street, Roslyn, Dunedin, N. Z.
(March to July).

1hw, 1xam, 1ukk, 2ar, 2mo, 2ik, 3ccu, 4nx, 4my, 4xl, 5nld, 5ajh, 5amo, 5aru, 5ckh, 5ny, 5pa, 5qx, 6ano, 6asr, 6awh, 6awp, 6alk, 6arb, 6aak, 6aos, 6buo, 6bur, 6bfa, 6bfw, 6bvr, 6bri, 6cgw, 6cmi, 6gm, 6ih, 6xad, 7pf, 7sc, 8ago, 8bcp, 9agk, 9adl, 9aul, 9bcp, 9bes, 9cpo, 9dzv, 9dge, 9me, 9xax, 9xba, 9zt.

S. K. Lewer, 6LJ.
32 Gascony Ave., West Hampstead,
London N.W.6., England.
(July 25, 27, August 3, 10, 17)

1abf, 1afi, 1axa, 1bdu, 1bdx, 1bie, 1boa, 1bxp, 1cab, 1ccg, 1gv, 1ka, 1ra, 1sf, 1xae, 1xak, 1xal, 1xw, 1za, 1zab, 2aai, 2abu, 2afp, 2bqb, 2by, 2byc, 2cei, 2cg, 2cue, 2iw, 2xi, 3aoj, 3apv, 3av, 3cdk, 3cjn, 3kq, 3ng, 3ov, 3pv, 3uh, 3xx, 4dx, or 4bx, 4ft, 8add, 8avl, 8dn or 8dd, 8fj.
Can.: 1ar, 1aw, 1bq, 1dd, 1ei, 9xw.
All crds QSL'd.

Major Raven-Hart, Los Anes, Chile. (Chilean 9TC)

Heard since June: 1ajp, 1ccx, 1gv, 2cgt, 2xi, 3ix, 3abw, 4fs, 4ft, 4ix, 4je, 4sa, 4sq, 5amw, 5ck 5ft, 5nj, 5vo, 6cgw, 8brc, 8cei, 8xs, 9amb, NKF.
Cuban 2by, Italian Navy ship 1HT heard while at Bahia.

Fernando Castano, Fernandez De Los Rios, 25,
Madrid, Spain.
(Spanish AR2)

9ali, 8cyi, 2rs.
eAR" would be glad to hear from American amateurs.
QRK my 100 watts? Answer to name and address above. On air after Oct. 1st.

1CNA on board U. S. S. Acushnet,
Woods Hole, Mass.

4af, 4bx, 4dx, 4ft, 4hz, 4io, 4ku, 4mb, 4sa, 4sh, 4un, 4xg, 4zd, 5air, 5aiy, 5akn, 5apc, 5en, 5dn, 5hp, 5mi, 5nj, 5nt, 5oq, 5ot, 5ph, 5rg, 5sg, 5uk, 5vv, 6bwl, 6cfz, 6cgw, 7agi, 7ahs, 7ob, 9aau, 9aey, 9ahh, 9ahp, 9ahq, 9ajs, 9alb, 9aot, 9apy, 9ato, 9ayh, 9bak, 9bbx, 9bcx, 9bel, 9bfx, 9bga, 9bgn, 9bib, 9bjm, 9bkj, 9blb, 9bmk, 9bmu, 9bna, 9bpd, 9bpt, 9ccm, 9cco, 9cii, 9cip, 9cnb, 9ctr, 9dbf, 9dct, 9ddp, 9djd, 9dlw, 9dqr, 9drr, 9duj, 9dxq, 9ear, 9efz, 9eiv, 9eji, 9ekh, 9eky, 9eld, 9em, 9es, 9fy, 9hm, 9hp, 9hu, 9hw, 9kq, 9uc, 9tt.
Special: 3xx, 3zo, 4xg, 4zd, 5zas, 7zx, 9za, 9zt, 9zk, 9xbd,
Phone: 4dx, 4ft, 8brc, 8dat, 8xab.
Can.: 1ar, 1bq, 1dd, 1ei, 2be, 3afp, 3bq, 3fc, 3gg, 3he, 3kq, 3vh, 3wp, 4ab, 4cr, 4dm, nfv, nkf, whu, wnp.
Foreign: uft.

5ZAV at sea

Tampico: 1ei, 4eq, 4fs, 4ix, 5ame, 5aex, 5agl, 5agn, 5amk, 5acj, 5acf, 5amw, 5ajh, 5all, 5agf, 5aen, 5aa, 5bo, 5ck, 5es, 5ew, 5gi, 5iq, 5ii, 5lm, 5nh, 5nn, 5nj (loudest), 5ns, 5oc, 5ox, 5oq, 5pk, 5qx, 5rg, 5to, 5uw, 5uk, 5ux, 5vo, 5vu, 5wy, 5xaw, 5xab, 5xbf, 5zas, 6bbh, 9aau, 9ahn, 9amb, 9aim, 9avx, 9bkk, 9cym, 9cee, 9elb, 9eky, 9vm, 9mc, 9zt.
Mex.: bx, 1k. Cuban 2by. Kdka, wgy 100 meter.
At Puerto Mexico, July 23: 5alz, 5cc, 5hp, 5rg, 5nk, 5nj, 5ns, 5zb, 5zd, 9dqu. Kdka.
At Frontera (Mexico), July 25th, 1924: 1xae, 5pk, 5akn, 5agn, 5fm, 5ft, 5hg, 5nj, 5oq, 5ua, 5uk, 5vq, 8xao, 9amb, 9dgm. Kdka.

c2BN at sea near Hamburg, Germany.

Aug. 23rd: 1gv, 1bqt, 1bvb, 1yk, 2by, 2rb, 2bbx, 2bgo, 2bmr, 2bqb, 2cei, 2cbk, 3bj, 3gc, 3zo, 3bna, 3bta, 3ccv, 3cjn, 4sb, 5nj, 8cko, 8hv, The loudest by far was 1gv. Receiver, 1bgf tuner and 1 step.

Can. 3VH, 56 Madison Ave., Toronto, Ont.

(4ft), (4bx), 4qy, (5akn), 5afq, 5ce, 5in, 5oq, (9aau), (9aks), (9arf), (9axr), 9bcx, 9bdu, 9bmk, 9btk, (9cei), 9ckh, (9dfq), (9dol), 9dqu, (9duj), (9ebh), 9eht, 9ed, (9uc).
Can. 4cr, (vdm), abt 400 m South of Etah.
Foreign, poz, uft.

A. Emich, U. S. S. N. 3
New London, Conn.

1db, 1dl, 1gb, 1gc, 1gh, 1hr, 1jw, 1kr, 1kv, 1oa, 1ov, 1ow, 1py, 1rg, 1ro, 1ru, 1sk, 1um, 1zk, 1zp, 1aac, 1aap, 1abf, 1abi, 1abt, 1aex, 1afa, 1afc, 1afi, 1afl, 1aht, 1afu, 1ahl,1aid, 1aix, 1ajr, 1ajt, 1akz, 1all, 1anh, 1anq, 1aos, 1aqi, 1aur, 1avj, 1awu, 1awx, 1axa, 1aya, 1ayz, 1axr, 1bcb, 1bcy, 1bdx, 1bie, 1biz, 1blu, 1bmr, 1bpw, 1bqe, 1qu, 1bqq, 1brj, 11btq, 1bwj, 1cac, 1ccx, -cgh, 1cgj, 1cjg, 1cmp, 1cmx, 1cpj, 1cwp, 1sap, 2al, 2bt, 2by, 2cj, 2cv, 2el, 2em, 23v, 2gk, 2iu, 2ju, 2kx, 2le, 2mo, 2rb, 2ub, 2um, 2wr, 2acs, 2aef, 2aeq, 2aey, 2aig, 2akn, 2anh, 2apy, 2asx, 2aue, 2aup, 2awv, 2bbi, 2bbx, 2beo, 2bjo, 2bkr, 2bmr, 2bqb, 2bqe, 2bqr, 2brb, 2bxw, 2cgk, 2cgo, 2cqr, 2chg, 2cjo, 2ckl, 2cmk, 2cok, 2cql, 2cqn, 2cqz, 2crj, 2cro, 2crw, 2ctq,

2cui, 2cvu, 2cvj, 2cwj, 2cxk, 2czb, 2xab, 3ch, 3fe, 3ia, 3kq, 3mo, 3oe, 3oo, 3qt, 3tf, 3tt, 3zo, 3zt, 3acr, 3afp, 3ago, 3aha, 3anj, 3aoj, 3apv, 3aqg, 3awv, 3bcl, 3bdo, 3bkl, 3bnu, 3bta, 3btu, 3buv, 3btp, 3bvd, 3bvl, 3cdk, 3che, 3cgs, 4ft, 4gl, 4gv, 4io, 4lc, 4oi, 4rt, 4xe, 5ft, 5gh, 5ub, 5amh, 6gw, 6awt, 6xa (d), 7fd, 7zu, 7aez, 7aez, 7azz, 8aq, 8bt, 8hv, 8kt, 8nu, 8pj, 8pv, 8rk, 8rv 8ry, 8uf, 8zz, 8aan, 8aig, 8aii, 8aqd, 8avl, 8bko, 8blc, 8bnd, 8rc, 8brm, 8bsq, 8btc, 8buc, 8bvd, 8clc, 8clx, 8cnq, 8cuv, 8cxm, 8daa, 8dgf, 8dgp, 8dmr, 8dsn, 8dtc, 8duf, 8gpu, 9vh, 9xw, 9abb, 9afi, 9agl, 9aps, 9asy, 9avh, 9btj, 9bwf, 9cee, 9cza, 9doe, 9dqu, 9dlj, 9dsl.

Jupu, 3xap, 6xa probably 6xad.

Canadian 9al, 3fs, 5ap, 4mx, 2ab.

1AAC, Framingham, Mass.

All below 100 meters: (4io), (4sa), 4xe, (4xx), (4zd) 5ame, 5il, 5on, (9aei), 9ahq, 9auw, (9bex), 9ccw, (9cil), (9cip), 9cvs, 9cxx, 9dbf, 9det, 9djd, 9dpx, 9dqa, (9elb), 9eld, (9em), 9tt, 9xbb, (9za), 9zt, (nfv), (nkf), (wvp), wwv.

Foreign: lps, pos, uft, cb2 (qra?)

1ABA 46 Summer St., Hyde Park, Mass.

4dx, 4ft, 4rz, 4uk, 5ajf, 5bx, 8aex, 8agt, 8ah, 8apn, 8aq, 8avx, 8bey, 8bjd, 8bp, 8bzg, 8bzr, 8dmr, 8dmz, 8qh, 8sz, 9aal, 9ahz, 9bgf, 9bmu, 9bru, 9buy, 9efk, 9mu, 9tw, 9ux, 9xby, 9zt. whu.

Can. 2-be, 3oh.

French, "Parie" and uft.

German, lps.

Argentina, cb-8.

Norman H. Miller, 1AWE, 25 Phillips Street, Providence, R. I.

4bl, 4dv, 4dx, 4ft, 4hr, 4hw, 4io, 4oa, 4ru, 4sa, 4zd, 5agn, 5aiy, 5amh, 5ape, 5aqp, 5dw, 5in, 5ru, 5vv, 6agk, 6apw, 6awt, 6brf, 6bt, 6bvz, 6bwl, 6cgw, 6chl, 6cnl, 6pl, 9aau, 9ach, 9aei, 9aey, 9aoo, 9bcx, 9bfl, 9bhi, 9bkj, 9bkk, 9bmk, 9bpf, 9bty, 9bup, 9caa, 9cdv, 9cfi, 9cgy, 9chi, 9cho, 9cip, 9co, 9cpu, 9csq, 9dky, 9dma, 9doa, 9dqg, 9ecs, 9egu, 9eky, 9xky, 9xbb, 9xbg, 9za, 9zt.

1PY 34 Ellington St., Longmeadow, Mass.

4bx, 4dv, 4dx, 4ft, 4hw, (4io), 4pk, (4pv), 4oa, 4sa, 4sy, 4xx, 5in, 4oq, 5qk, 5sg, 5vv, 5agn, 5ape, 5zas, 6cgw, 9em, 9hm, 9hr, (9hw), (9oa), 9zt, (9aad), 9aau, 9aal, 9acq, 9agl, 9aic, 9aii, (9alb), 9arp, (icw), 9ato, 9awm, 9bcb, 9bkj, 9bmk, 9bmu, 9bpd, 9bvn, (9btk), 9bye, (9ecf), (9eco), 9edv, 9cee, (9cek), 9cfs, 9cii, (9clx), 9emf, (9cwp), 9exx, 9cze, 9dbj, (9det), 9dei, 9djd, 9dkv, 9din, 9dmj, 9doe, 9dqa, 9dqe, 9dqu, 9dwx, 9ebh, 9eky, (9eld), (9elp), 9xbg, 9xbh.

Canadian. 3oh, 4cr.

Short wave, nkf, nfv, nerk2, poz, vdm.

2AEY, Elizabeth, N. J.

1abs, 1aco, (1aeo), (1ahl), (1ajo), 1ajt, (1jx), (1all), (1bbx), 1bym, 1cmx, (1gh), (1zt), 1rq, 1se, (3acc), 3api, 3avg, (3bez), 3bkl, 3bmn, 3bta, 3buv, (3cdk), 3cdn, 3cfc, 3cgc, 3chc, (3cka), 3ckl, (3xan), (3bm), (3bu), 3dk, 3lg, (3mk), 3tf, (3qt), (4ft), 4hw, 4io, 4it, 4jr, 4pv, 5ape, 5fv, 5ml, 5nj, 5sg, 5vv, 5wi, 5zb, 6cgw, 6lv, 6fp, 8aat, (8acm), 8aii, 8ams, (8vd), 8bbf, 8bcb, 8bhy, 8bjt, 8bkir, 8boa, 8brc, 8bzf, 8cci, (8cmh), 8cnq, (8con), 8cpq, (8cud), 8cuv, (8cxm), 8daa, 8dgo, 8dgw, 8dhs, 8dhu, 8djf, (8dki), 8dmv, (8doo), 8doq, 8dsn, 8dtw, (8aq), 8bp, 8cb, 8gz, 8hv, 8ku, (8uf), 8wo, 8wz, 8rh, 8rj, 8sf, 8tt, (9taa), 9afk, 9arp, 9biu, 9bmu, 9bsf, 9cfk, 9djz, 9dyy, 9hk, 9hw, 9vm.

Can. 2bn, (3oh).

2CYX, Bronx, N. Y.

(nbf), (1afa), 1ajo), 1ajx, (1ams), (1arf), 1aul, 1avg, (1axf), (1bbx),(1bcc),(1bgg),(1bkf), (1bkp), (1btt), (1bqf), 1cab, 1cue (1cmx), (1df), (1gc), (1he), 1ka, (1fn), (1nc), 1pi, 1py, (1rf), 1rg, (1rw), (1se), 1xw, 1zo, (1vu), 4af, 4bx, 4es, 4dx, 4fs, (4ft), 4ga, 4gw, 4hr, 4hw, 4io, 4ld, 4oa, 4ot, (4og), 4pv, 4ru, 4sw, 4un, (4mb), 4qf, 5agn, (5agv), 5aiy, 5amn, 5ape, 5arn, 5zae, 5uf, 5mi, 5pk, 5pu, 5uk, 5xn, 6as, 6awt, 6cgw, 7bc, 7eo, 7fd, 7it, 7no, (8ay), 8bn, (8bt), 8rt, (8sf), (8tt), (8uf), 8ut, (8vq), 8xz, 8aan, 8acm, (8add), 8aer, (8ajn), (8akk), 8ams, 8aqo, 8avl, 8avl, 8avx, (8axf), 8bkh, (8brc), 8bam, (8cci), (8cct), (8cdc), (8cei), (8clc), 8cni, 8cnq, 8cud, 8cwu, 8daa, 8dat, 8dem, 8dge, 8dkl, 8dmr, 8dmt, (8dnb), (8doq), 9aaw, 9ado, 9afk, 9aii, 9ako, (9aps), 9arf, 9arr, (9atn), 9avy, 9bcc, 9beb, 9biw, 9bjo, 9bna, (9bmk), 9bmu, 9bpt, 9bsp, 9bty, 9bwp, 9bye, 9byt, 9ccf, 9cch, 9ccw, 9cdv, 9cfi, 9cfk, 9cip, (9ckh), 9csg, 9cvf, 9dbj, 9del, 9dlw, 9dpx, 9dul, 9dvw, 9ebh, 9eky, 9elb, 9eld, 9ejl, 9av, 9es, 9hr, 9pq, (9uc), 9tg.

Can. (2be), 2cg, (3bq), (3co), 3ni, (3vh).

3TF, Ruxton, Md.

(1ccz), (2cnk), 4af, (4dx), (4hw), 4io, (4jr), 4tj, (5aiy), (5akn), (5apc), 5mi, (5sg), 5vv, 5zas, 6cgw, 7ot? (8dfm), (9apy), (9arf), 9azr), 9bcb, 9bgx, (9bkj), 9bmu, 9bmv, 9bpy, (9bwf), (9cbz), (9ccw), 9cej, 9cfi (9coc), 9cov, 9dbj, (9dbm), (9dbp), 9dfq), (9dmj), 9duj, 9dvi, (9dvw), 9abh, (9efz), (9gp), 9ie, (9lz), (9uc), (9zk).

Canadian: 3gk, 3ni, (300), vdm, nkf, kwhu.

French: uft.

German: poz.

Porto Rico: (4sa).

3HW, 3CS, ex-3CP on Delaware River Expedition See "Communications" in this issue.

Sept. 13th; 1gh, 1zt, 1bef, 1btf, 2rk, 2xd, 2aar, 2cuk, 2cxi, 2cyw, 2ac, 2bg, 3mo, 3wb, 3abw, 3acr, 3edk, 4kk, 4mb, 4qf, 4si, 5ek, 5mb, 5qh, 5uk, 5alz, 5amh, 5aqm, 8ako, 8bow, 8byb, 8byn, 8ced, 8emt, 8coo, 8dmy, 9adh, 9bjl, 9cil, 9ded, 9dth, 9xbe, nrj.

4DX-4SY, 902 N. Main, Greenville, So. Car.

(1abf), 1abs, 1aer, 1aii, 1ajg, 1ajp, 1ajx, 1alj, 1apj, 1arf, 1ayt, 1bag, (1bb), 1bbe, (1bbo), 1bdx, (1bgq), 1bie, (1biz), 1bjo, 1brx, 1bwj, 1ack, 1caz, 1ego, 1ckp, 1emp, 1epe, 1epo, 1cqn, 1etp, 1fb, 1gv, 1ii, 1ke, 1mo, 1my, 1rr, (1rw), 1sf, (1sz), 1wj, -wr, 1xaq, 1xu, 1zm,. (2aay), (2acs), 2agq, 2ayv, 2azy, 2bbx, 2bgg, (2bgi), 2bgo, (2bmr), (2bqb), 2brb, (2bqb), 2bvy, 2by, (2byk), (2cae), 2cdv, (2cee), 2cei, 2cg, 2cnk, (2cqp), 2cqx, (2crq), (2cvj), 2cwp, 2dx, (2kk), 2le, (2lv), 2mt, 2rb, (fone), (2rk), 2ry, (2sy), 2wc, 2wd, (2wr), 2ws, 2xbf, 2xbu, (3ach), 3acr, (3adb), 3adc, 3adj, 3adp, (3afs), 3agf, 3ahp, 3avg, 3ajj, (3aky), 3aoj), 3api, 3apu, 3apt, (3apv), (3aqr), (3ava), 3bcf, 3bch, 3bco, (3beg), (3bm), (3bmn), 3bmz, 3bno, 3bnu, 3bof, (3bta), (3buy), (3bva), (3bvl), 3bvu, 3bwt, 3ea, 3cbx, 3ccu, 3ccv, (3cdk), 3cdu, (3cel), (3cfc), 3cgi, 3cgn, (3cgq), (3cgs), (3chc), (3chh), (3cia), (3cjm), 3ckl, 3dq, 3ek, 3el, 3fb, 3ge, 3gk, 3gm, 3gz, (3hd), (3hh), (3hs), (3kq), 3lf, 3lg, (3mf), 3mo, (3nf), 3ni, (3oe), (3og), 3oo, (3at), (3ov), (3ph), 3sf), (3ta), (3tf), 3th, 3tj, 3uy, 3uh, 3xg, 3xx, 3yh, (3zd), 3zh, 3zm, 3zo, 4um, 5abc, (5anj), 5ac, (5acl), 5adv, 5adz, 5aex, 5agh, 5agn, (5agq), 5ahd, 5aic, 5aiu, 5aiy, 5aj, (5ajh), (5akw), 5akz, 5alz, (5amh), 5amu), (5aom), (5apc), 5ari, fone, qra? 5azn, qra? 5au,, (5bp), 5ck, 5cn, 5dw, 5eg, (5ek), 5ez, 5fm, 5fv, (5gi), 5gp), 5ew, 5ht, 5hu, 5ik, 5in, 5is, (5jf), 5jr, (5ka), 5kc), 5km, 5kn, (5lr),5ma, 5mb, 5mz, 5nj, 5nn, 5ns, (5nt), 5nw, 5oq, 5pk, 5qh, 5qj, 5qk, 5qz, 5rd, 5rg, 5rh, 5ru, 5rx, 5rz, 5sg, 5uk, 5um, 5ux, (5vv), 5vu, 5vx, 5vy, 5wa, 5wh, (5wi), (5wo), 5wp, 5xg, 6aat, 6abt, 6acm, 6afz, 6age, 6aid, 6amg, 6and, 6aol, 6aos, (6apw), 6avv, 6awt, 6bbc, 6bcg, 6bcp, 6beh, 6beo, 6bfw, (6blk), 6bpp, 6brf, 6cae, 6cbg, (cdn), 6cgp, (6cgw often), 6chz, 6ckp, 6cp, 6dd, 6eb, 6em, 6er, 6fm qra?, 6fp, 6ih qra?, 6kl, 6jf qra?, 6lv, 6od, 6pl, 6tv, (6xad), 6xl, 6zx, 6zbk, 6zar. 6zah, 6xbc, 7acb, 7acx, 7aek, 7aiy, 7eo, 7dc, 7fd, 7fq, 7hw, 7it, 7iw, 7jf, 7lj, 7lq, 7ot, 7tt, 7uu, 7zd, 7zu, 8abp, 8abq, 8adk, (8ads), 8aej), 8aer, (8ago), 8agw, (8agx), (8aip), (8ajn), 8ak, (8ab), 8alf, 8alk, 8alp, 8apn, 8app, 8apw, (8aq), 8aqf, 8aqk, 8art, (8atp), (8axf), 8axt, 8axx, (8azg), 8bbm, 8bda, (8bdv), 8bf, 8bfe, (8bgx), (8bhe), (8bhf), 8bhj, (8bho), (8bit), fone, 8biz fone, (8bjg), (8bkh), (8bkm), (8blk), (8blp), 8blw, 8bmb, 8bmt, 8bnf, 8bnh, 8bno, (8boe), (8boy), 8bp, 8bpa, 8bpl, (8bqb), (8bre) fone, 8brj, (8brm), 8bsf, (8bsu), 8bvr, 8bxm, 8bxv, 8bxw, 8bze, (8cab fone), 8cb, (8cc), 8cci, 8cck, 8cdt, 8cdx, 8cei, 8cfd, (8chp), (8cvp), 8cke, 8ckm, 8clo, (8con), 8cqh, (8cqx), 8cra, 8crw, (8cta), (8cud), 8cux, 8cvq, 8cwd, 8cwl, (8cwp), (8cxi), (8cxm), (8cxw), 8cyi, 8cyt, 8daa, (8daf), 8dat, 8dbm, 8dc, 8dde, 8ddx, 8dee, 8deg, (8dfm), 8dfo, 8dgl, 8dgp, 8dgr, (8dgv), 8dki, (dkm), 8dla, 8dmp, 8dnp, 8dmx, (8dnf), 8dnx, 8dpe, 8dpl, 8dpo, 8dqk, (8dsn), 8dtc, 8dua, 8er, (8fj), 8fm, (8fn), 8ga, 8ge, 8gs, (8gw), (8hb)qra???, 8hn, 8hv, 8ke, 8kg fone, (8kh), 8ki, 8kk, (8ku), 8qc, 8qb, 8qd, 8rj, 8rr, (8ry), (8sf), 8uf, 8ve, 8vn, (8vq), 8vt, 8wd, (8wz), 8xs, 8yae, 8zb, 8zg qra?, 8zae, 8zaf, 8xba, 9aal, 9aau, 9aav, 9aaw, 9ado, 9agl, 9ahl, 9aic, 9aiu, (9alb), (9aps), (9aru), 9asf, 9ash, 9ato, 9auc, (9aud), 9aun, (9auy), 9ave, 9ayl, 9ayx, 8baz, 9bcb, 9bce, (9bcx), 9be, 9beb, 9bhd, 9bhs, 9big, (9bio), 8biu, 9bjk, 9bk, (9bkk), 9blm), (9bmk spk), 9bmu, 9brd, 9bre, 9brx, 9bty, (9buk), 9bvz, 9bwf, 9caa, 9cah, 9cb, (9cco), 9ccs, 9ccv, 9ccw, 9cdz,

(9cea), 9cee, 9cej, 9cfi, (9cgn), (9cgq), 9cii, 9cow, (acp), 9csu, 9cxx, (9cze), 9czm, 9czo, 9czp, 9dae, 9day, (9dgv), (9dhl), 9dhs, (9dje), 9djn, (9djz), 9drs, 9dlo, 9dlw, 9dmj, 9dng, 9dnh, (9doe), 9dpx, 9drr, 9dsa, 9dsh, (9dsl), 9dsx, 9dte, 9dtk, 9dun, 9dwx, 9dxa, 9lxn, (9dxs), 9dxy, (9eak), 9efe, 9ei, 9eiv, 9eky, 9el, (9elq), 9enw, (9ed), 9er, 9es, 9ge, 9gs, 9hw, 9nu, 9eb, (9nu), 9oa), (9pq), 9pz, 9ss, 9ta, 9ux, 9nc, 9vz, 9wu, 9xbd, 9xax, 9yak, 9yl, 9zc, 9zg, 9zt, 9zy.

Mexican: gx.

Porto Rico: 4je.

Cuban: 2by.

Canadian: 1ar, 1bv, 1dj, 1dt, 1eb, (2bg), 2bn, 2fw, 3abb, 2adn, 3bq, (3gg), (3ly), (3oh), 3ph, (3ta), (3we), 4cl, 4co, 4hh, 5eh, 5go, 9al.

4RR, 290 Wofford Campus, Spartanburg, S. C.

1aac, 1ahw, 1ajp, 1ajx, 1all, 1ang, 1any, 1arf, 1are, 1aur, 1bie, 1bio, 1blx, 1bse, (1bwj), 1boq, 1ccz, 1cmx, 1cmy, 1ckk, 1epe, 1cue, 1ei, 1fu, 1gu, 1rv, 1nt, 1wv, 1xae, 1xaq, 1xw, 2aac, 1abt, 1adj, 2agd, 2ars, 2blm, 2bjo, (2bqb), 2bqh, (2brb), 2byc, 2bzo, 2cjj, 2cee, 2chz, 2cnd, 1cnk, 2cpa, 1cqa, 1crp, 22cxe, 2cyx, 2cyx, 2by, 2cu, 2dx, 2iu, 2mo, 2mu, (2kf), 2rb, 2rk, 2x,i 2xx, 3aoj, 2abw, 3ack, 3adp, 3aem, 3ner, 3ahe, 3ats, 3api, 3apv, 3ahp, 3auf, 3auu, 3avr, 3avn,)ayn, 3bco, 3ble, 2uy, 3bva, 3bng, 3bta, 3bsb, 3bwt, 3bdi, 3bvl, (3bmn), 3bux, 3bfe, 3btx, 3cki, 3chc, 3cka, 3ckl, 3cuu, 3cgc, 3cia, 3cfc, 3cxc, 3cjn, 3cdk, 3bg, 3bj, 3ca, 3fs, 3fr, 3gc, 3hz, 3hb, 3jo, 3kl, 3le, 3ll, 3mb, 3me, 3ph, 3sd, 3tf, 3uu, 3uv, 3zn, 3zo, 5adv, 5agv, 5aer, 5aey, 5amf, 5ago, 5ajh, 5apc, 4aex, 5ari, 5fs, (5ka), 5gi, 5ko, 5pk, 5nj, 5oq, 5qo, 5ru, 5to, 5ua, 5vv, 5wo, 5xa, 5zas, 6awt, 6aws, 6avv, 6cgw, 6hcl, 7eo, 7gr, 7qc, 9aa, 9aau, 9aal, 9aat, 9ayx, 9arr, 9azb, 9azy, 9aps, 9axp, 9asu, (9aii), 9auy, 9aei, 9arf, 9auw, 9avw, 9aoo, 9aun, 9ado, 9azi, 9bkk, 9bcb, 9baz, 9bmu, 9bkj, (9bmk), (9btk), 9byt, 9btv, 9bwy, 9bhb, 9bpt, 9bpx, 9bmo, 9chh, 9cbb, 9cdw, 9cpu, 9cfs, 9cng, 8emi, 9esz, 9cdv, 9evl, 9etd, 9eoc, 9cfz, 9cah, 9cze, 9enw, 9azl, 9cap, (9cek), 9cdp, 9cfi, 9cee, 9doe, 9dbf, 9dsa, 9dbm, (9dfq), 9dat, 9dwk, 9del, (9dmj), 9djp, 9ddp, 9dvw, 9dnn, 9dxr, 9dbj, 9dio, 9dex, 9eis, 9eld, 9eky, 9av, 9bk, 9ea, 9cm, 9em, 9es, 9ed, 9fj, 9hm, 9hp, 9hr, 9hw, 9oa, 9sz, 9tq, 9xbd, 9xbe, 9xbh, 9xw, 9zb, 9zt, nkf, nfv, wbi, whu, wcj.

Can.: 1bq, 1ei, 2be, 2cg, 3aa, 3ad, 3bq, 3co, 3fc, (3he), 3sp, 3vh, 5go, 9bc, 9bw.

Foreign: poz.

M. Castro Fernandez, 4RL and A. E. Saldana, 4TL.
No. 13 Olimpo Avenue, Santurce, Porto Rico.

1abf, 1aeg, 1ar, 1cgv, 1gv, 1rf, 1ze, 2ana, 2bml, 2bmr, 2bqh, 2by, 2cqz, 2cuk, 2cxv, 2iu, 2kf, 3bco, 3bva, 3cik, 3cjn, 3co, 3rs, 3zo, 4ai, 4bq, 4ft, 4fu, 4io, 4kl, 4pk, 4pv, 4rr, 4sb, 5ajh, 5nj, 5wi, 8apo, 8blc, 8brc, 8dgt, 8dt, 8xbp, 9aau, 9bmk, 9cch, 9cee, 9eld, 9zt, nkf, wgy.

Foreign: poz, lpz.

R. Bartholomew, 4SA.
Carrochales, Porto Rico.

(1aac), 1ahw, (1all), 1asm, 1ay, 1bwj, 1cg, 1cky, (1cmp), 1pk, 1ow), (1rf), 1sf), 1vk), 1xam, 1xw, 2aft, (2agb), 2bfm, (2cac), (2cu), 2ix, 2gk, 2ku, 2xab, 3bco, 3bva, 3cia, 3cjn, 3gc, (3tc), (ft), 4io, 4js, 4pv, 4oa, 4sb, (4xe), (zd), 5am, 5nj, 6cgw. 8bpa, (8ccr), 8efi, 8cyi, 8zg, (9aic), 9aii, 9cfi, Poz and Paris are Qsa hr. Also 2yt calling 1ccm (daylight).

5JF, Marshall, Texas.

gbsc, 2cqx, 3zr, 4ai, 4cs, (4du), 4dv, (4dx), 4eq, 4fg, 4fs, 4ft, 4fx, 4gw, (4hz), 4in, (4io), 4iz, 4nz, (4oa), 4pq, 4sa, (4si), 4tj, 4ll, 4zb, 6adm, 6brf, 6cae, 6cgo, 6cgw, 6cng, 6cto, 6mh, (8aal), (8abm), 8atp, 8avx, (8bci), 8bhe, 8brc, 8cmc, (8cwp), 8cwu, 8dnu, 8doc, 8dom, (8dsn), 8hv, 8ry, 8xbh, 8zg, vdm, nkf, whu, kdka.

Mex.: if.

5KC, Plaquemine, La.

2by, 2bqb, 2cvj, 3ad, 3age, 3auv, 3buy, 3bva, 3buv, 3xav, 4dt, 4dx, 4kk, 4pd, 4qf, 4sa, 4ua, 5ck, 5fm, 5gi, 5hp, 5in, 5jf, 5lm, 5mb, 5mi, 5nn, 5oj, 5oq, 5ph, 5qh, 5se, 5sg, 5zk, 5nai, 5acf, 5adv, 5agv, 5air, 5ajt, 5apc, 5apm, 5zas, 6aao, 6cek, 6cgw, 8es, 8hv, 8tt, 8vq, 8yn, 8aey, 8abm, 8alw, 8anm, 8apw, 8art, 8bma, 8brc, 8cta, 8cwc, 8cxm, 8dbm, 8dbo, 8dcr, 8dem, 8dgo, 8dnh, 8doo, 9oa, 9tg, 9vc, 9zd, 9aau, 9akd, 9acb, 9asz, 9att, 9baz, 9beb, 9bjp, 9bpd, 9bpy, 9cao, 9cco, 9cfi, 9cjs, 9ckh, 9chv, 9day, 9del, 9dix, 9duj, 9dun, 9eji, 9eky, 9xbe.

Can.: 3ad, 4cr.

5AJH, Abilene, Texas.

1bwj, 2cu, 2gk, 2rk, (or jrk?), 2xi, 4fs, (4io), 4kl, 4oa, 4pv, 4tj, 6ajd, 6aji, 6atz, 6awt, 6bjx, (6blq), (6cae), (6cbb), 6cct, (6cek), (6cgo), (6cgw), 6cng, 6ji, (6of), (6vd), (7gr), 7no, 7sf, 7zn, 8bet, 8brc, 8bxf, 8cdc, 8cwu, (8cyi), (8dfb), 8drp, 8xs, (9adr), 9ahj, (9aks), (9auw), (9awm), (9ayx), 9bcx, 9bfp, 9bhd, (9bqh), (9bzi), (9ccw), 9cee, (9cfi), (9cfk), 9cfy, (9cip), (9cog), (9cpu), (9dei), (9djp), (9dpx), (9eak), (9eam), 9eao, (9eht), 9eky, (9ela), (9hn), (9qw), (9rb), 9xbb, (9zt).

Can.: 3aa, (4fv).

1rv, (2cee), (2chz), 2cyx, 2qs, 3bdi, 3bfe, 3bnt, 3bta, 3rv, (4af), (4fq), 4oy, 4pv, (6agk), 6alf, (6cgs), 6chl, 6crx, (6ms), 6pq), 6tn, (6vd), 7gr, 7io, 7qc, (8ada), 8cci, (8dbm), 9bqy, (9clq), (9cyz), 9djd, (9dxw).

Can.: 3bq, (4fv), 9av.

Hot dawg! DX wx agn. Hrd mi cw?

6FL, 1749 Magnolia Ave., Los Angeles, Calif.

1xae, 3cy, 4pb, 4xf, 5ank, 5az, 5bc, 5ce, 5do, 5lq, 5mi, 5rg, 7acf, 7acl, 7acr, 7ahs, 7alc, 7aif, 7akk, 7cq, 7ga, 7gu, 7ij, 7im, 7io, 7it, 7kn, 7ld, 7ln, 7lw, 7mv, 7nb, 7no,, 7ob, 7od, 7ok, 7ot, 7pz, 7qc, 7ry, 7ub, 7un, 7zn, 8aj, 8cwp, 8du, 8xs, 9aal, 9abc, 9acb, 9acf, 9ahs, 9ajr, 9amb, 9ano, 9ash, 9asz, 9ax, 9bsw, 9bun, 9bx, 9car, 9cav, 9cca, 9cct, 9cdr, 9cfu, 9cfy, 9cju, 9cnd, 9co, 9cpf, 9cpu, 9csa, 9cto, 9cty, 9cus, 9cvu, 9ded, 9dkv, 9dt, 9dte, 9dqa, 9dqe, 9eae, 9eam, 9ely, 9ejn, 9eky, 9jn, 9kq, 9td, 9tf.

Can.: 4gt, 5gg, 5gj, 5go, 5gt.

2823 East Sixth Street, Los Angeles, Calif.

5ajh, 5ak, a5kd, 5akn, (5amo), 5lm, 5nj, 5oq, 7aby, 7agi, 7aiy, 7fr, (7gr), 7gv, 7ij, 7ls, 7no, (7nw), 7ok, (7qc), (7sf), 7ui, 9amb, 9axx 9cfl, 9cld, 9dkv, 9doe, 9dxy, (9eam), 9eky.

Can.: (5cn), 5gg, 5go.

6CTE, Brookdale, Calif.

4pb, 5agn, 5ajh, 5akn, 5amo, 5bu, 5ef, 5gf, 5lg, 5mi, 5ux, 5xv, (7agz), (7ajq), (7akk), (7alk), (7av) (7em), (7dd) (7dz) (7gr) (7gv), (7kb), (7kv), (7ls) (7mf), (7no), (7nw), (7pj), (7pz), (7qy), (7tq), (7un), (7vn), 8apn, 8bit, 8brc, 9ado, 9agl, 9ahs, 9bm, 9bng, 9bxe, 9caa, 9ccs, 9cfl, 9cju, 9cpu, 9dbf, 9dkv, 9dng, 9dpx, 9eae, 9eam, 9efy, 9as, 9zt.

Can.: 4gt, (5ch), (5gg), (5go).

South American: Venezuela C9G. C9G—QRA? pse.

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6 BBV, J. Barsby, 518 W 50 st., Los Angeles.

5ado, 5amo, 5ao, 5cn, 5go, 5lr, 400-6s, 7aak, 7acf, 7acu, 7adg, 7adp, 7aek, 7af, 7ahs, 7aif, 7aiv, 7aj, 7ajq, 7akk, 7ald, 7av, 7bj, 7em, 7go, 7gr, 7ha, 7ju, 7jw, 7ke,7ls, 7mf, 7mi, 7no, 7ok, 7pz, 7rk, 7ry, 7to, 7wm, 7xa, 9bm, 9bqf, 9caa, 9cfy, 9cju, 9cpu, 9dkv, 9dte, 9eam, 9eky.

Can.: 5go.

Low Loss Tuner, 1 Tube used.

7NO, Aberdeen, Wash.

5ak, 5bw, (5ge), 5lg, 5nj, 5rg, 5ux, (5ze), (5acl), (5akd), (7aeb), (7it), (7mn), (7qs), 8abs, 8cwu, 8hv, (9bm), 9ee, 9hk, 9xt, 9aax, 9acq, 9aep, 9amb, (9amp), 9avv, (9azg), (9bkk), 9btk, 9bwv, 9bye, 9cbf, 9cco, 9cdo, (9cld), (9cpu), 9csi, 9cyg, 9day, (9dip), 9doe, 9dmj, 9dng, (9dqu), 9eam, 9eep, (9egu) 9ejn, 9eky, 9eli, 9xnv.

Can.: 3ni, (4aa), 4aw, 4bf, 4cr, 4er, 4gt, (4io), 9ac, 9ax.

Received on one tube.

E. E. Harper, P. O. Sta. A., Vancouver, Wash.

1af, 2by, 2bco, 2byw, 2cqx, 2pd, (5ajh), 5akn, (5amd), 5ck, 5ex, (5in), (5nw), 5nj, 5oq, 5rg, 5ua, 5xaw, (7mn), (7qa), 8abm, 8bit, 8bkh, 8brc, 8bva, 8cei, (8dtg), 8er, 8hn, (8ry), 8uq, 8vy, 8xs, 9abc, 9ado, 9adw, (9aey), 9agl, 9amp, 9bm, 9bmk, 9bop, 9bqj, 9caa, 9cfi, 9clb, 9cls, (9cip), (9cpu), 9dky, 9dng, 9doe, (9dpx), (9drx), (9dqe), 9drt, (9eam), 9ebh, 9efy, 9eld, 9eli, 9es, 9ql, 9xlw, 9zt.

Can.: 3gg, (3ni), 3oh. 4er, (4fv), (4hf), 4io, (4gt), (vdm).

Roy Bucy, 7VM, aboard WP 2, Cook Inlet, Alaska.

July 1 to 31: 5ez, 5in, 5ux, 5amu, 5aqw, 6gq, 6gu, 6ih, 6ja, 6jj, 6jp, 6km, 6pu, 6rb, 6rm, 6ry, 6ti, 6ub, 6abe, 6adt, 6afo, 6age 6aja, 6ajf, 6ajh, 6alw, 6amj, 6amm, 6amo, 6any, 6aps, 6apw, 6atn, 6avj, 6bcf, 6bds, 6bfw, 6bgh, 6brf, 6cae, 6cas, 6cbb, 6cdy, 6cfx, 6cgl, 6cgo, 6cgw, 6cjv, 6cng, 6cqe, 6cte, 6cto, 6xbj, 7af, 7ar, 7av, 7bj, 7by, 7dj, 7dm, 7dx, 7dz, 7ei, 7fd, 7fr, 7ge, 7gq, 7gp, 7gr, 7gv, 7hh, 7ij, 7ix, 7jq, 7jw, 7kb. 7ln, 7ls, 7lw, 7ly, 7mf, 7mi, 7no, 7nx,

7ob, 7od, 7pz, 7qc, 7rw, 7ry, 7vn, 7wm, 7zm, 7adi, 7aek, 7afo, 7aif, aiy, 7aim, 7akk, 7akt, 7akv, 7alk, 7apf, 8bl, 8brc, 9aau, 9amb, 9aob, 9bpy, 9cnn, 9cnj, 9cpu, 9dgv, 9dkv, 9dxr, 9eam.

Can.: 4ab, 4gt, 4hf.

August 1 to 31st: 2kx, 3ni, 3tf, 3bco, 4ft, 4oa, 5ak, 5nt, 5oq, 5pa, 5rg, 5sg, 5uj, 5uk, 5agn, 5aju, 5akn, 5akz, 5ame, 5anf, 5aqp, 5xab, 6eo, 6ew, 6fh, 6ii, 6jp, 6lv, 6lu, 6mh, 6ms, 6nb, 6nh, 6qh, 6tn, 6aao, 6adb, 6afq, 6agk, 6als, 6amf, 6amg, 6amo, 6aof, 6aou, 6apw, 6atc, 6avj, 6awt, 6bav, 6bcp, 6bdn, 6beb, 6bfw, 6bgb, 6bhw, 6bjx, 6bka, 6bql, 6brf, 6bso, 6bts, 6buf, 6cbd, 6cdg, 6cfg, 6cgo, 6cgw, 6chl, 6clv, 6cmu, 6cnh, 6cqo, 6csw, 6ctd, 6cto, 7ar, 7av, 7ca, 7fr, 7gk, 7gr, 7gv, 7ih, 7ij, 7ix, 7js, 7ku, 7ly, 7lw, 7mf, 7nw, 7ow, 7ox, 7pm, 7qc, 7qy, 7ry, 7sf, 7abi, 7acm, 7aek,, 7afo, 7aiy, 7akk, 8er, 8vq, 8avx, 8axf, 8cci, 8cwu, 8cxi, 8dem, 8dfb, 8dhs, 9bm, 9ed, 9hm, 9hw, 9my, 9zt, 9aao, 9abc, 9adp, 9aed, 9aei, 9aey, 9ahh, 9ahj, 9akk, 9aks, 9amf, 9aml, 9amp, 9atn, 9auy, 9bcb, 9bdu, 9bhd, 9bmk, 9bnf, 9bpt, 9bpy, 9btk, 9btx, 9bxa, 9bxg, 9caa, 9cbl, 9cdv, 9cee, 9cen, 9cfi, 9chc, 9cld, 9clg, 9cnb, 9cxy, 9ddp, 9ded, 9dge, 9djd, 9dmj, 9dol, 9dpx, 9dqe, 9dqu, 9dre, 9dvy, 9dyy, 9dzy, 9efy, 9efz, 9egu, 9eky.

Can.: 4bf, 4fv, 4gt, 4hf, 4ats, VDM Vry QSA hr.

Address cards to 7VM.

8RY, Sullivan, Ohio.

1gv, 1ow, 1py, 1rv, 1se, 1aac, 1abf, 1acs, 1aeg, 1ajt, 1alj, 1all, 1axz, 1bbp, 1bdx, 1eue, 1emx, 1epc, 2by, 1cv, 2dq, 2kf, 2le, 2adk, 2agd, 2ana, 2aww, 2azy, 2bck, 2bmr, 2cvj, 3bj, 3uu, 3aha, 3bco, 3bta, 3cgs, 4dv, 4hw, 4kl, 4oa, 4rr, 4sa, 4sh, 4tu, 5ez, 5fs, 5kq, 5oq, 5wi, 5akw, 5anl, 5aqw, 6cfz, 6cic??? 7fd, 7no, 7gr, 9es, 9kb, 9nq, 9oi, 9uc, 9aad, 9alb, 9amb, 9and, 9aps, 9ash, 9baz, 9bcb, 9bcx, 9bhd, 9bmu, 9bzi, 9cee, 9cei, 9cgr, 9cii, 9cnb, 9cqz, 9dct, 9ddp, 9del, 9dhl, 9djz, 9dlj, 9dmj, 9dng, 9dpx, 9dqe, 9dsl, 9dsn, 9elz, 9efy.

Specials: 1xw, 1xaq, 1xay, 1se, 1zab, 3xauv, 3zp, 4xz, 5zb, 5zas, 8xab, 8xbn, 8zg, 9xbd, 9zk, 9zt.

Can.: 3aa, 3be, 3xx, 3yk, 3vh, 5go.

8VQ, Freeport, Pa.

1fn, (1py), 1sf, (1vk), 1zt, (1abt), 1ahl, 1aos, (1axa), 1bcc, 1bgt, 1bhl, (1bpz), 1cam, 1cti, 2by, (2acs), (2aid), (2aoy), 2bbx, (2bco), (2bgg), (2boi), 2bsc, (2byk), (2cdm), 2cnk, 2cqz, 2ctq, 2cyu, (2cyx), (2czr), 3du, 3lg, (3og), 3wx, 3xp, 3afp, 3aoj, 3bco, 3bhl, (3bqp), 3bva, 3cdk, (3cfc), (3cgs), 3chc, (3cjn), (3ckl), (3cla), 4af, (4dx), 4ft, 4hw, 4io, (4mb), (4oa), 4pv, 4sh, 5ae, 5cn, (5gp), 5kr, 5afg, (5agn), (5apc), 5zai, 6jf, (6cgw), 9hr, (9hw), 9ao, 9pq, (9tg), 9uc, 9zk, 9abb, (9aem), 9aii), (9alb), 9arf, 9arr, 9aud, 9awm, 9axj, (9bcx), (9bdu), 9beb, (9bmc), (9bmk), 9btk, (9bwb), (9bwf), 9cef, (9cex), 9cea, 9cee, (9cek), (9cfi), (9cfs), 9cur, 9czl, (9dbj) dalite, 9dct, (9dei), 9dga, (9dhz), (9dnc), 9dng, (9dln), (9duj), (9dxr), 9eky, (9xbb).

8BKM, Conneaut, Ohio.

Dalite: 80 meters and lower. 1aac, 1blx, 1epj, 1my, 1sf, 1xw, 2brb, 2cnk, 2mu, 2pd, 3adp, 3ahp, (apv), 3bdi, 3bpp, 3bta, 3bvu, 3ckj, 3lg, 3rs, 9auw, 9cii, 9cvs, 9dbj, 9dct, nfv, nkf.

Nite, all Amateur Waves: 1aac, 1ahw, 1alj, 1all, 1apc, 1aqi, 1are, (1arf), 1aww, 1ayt, 1bes, 1blx, (1bqf), 1bqg, 1bwj, 1bym, 1ccz, 1cg, 1cgv, 1cmx, 1cpa, 1cqk, 1iv, 1my, (1pd), 1rf, 1rp, 1sf, 1xw, 1xp, (2acs), 2adk, 2axf, 2bjo, 2bmr, (2brb), 2by, 2byn, (2cbk), 2crq, 2cv, 2cqz, (2cwj), 2cyq, 2eb, 2gk, (2le), 2mu, 2pd, 2xx, 3adp, 3adt, (3ahp), 3ajd, (3apv), 3bco, 3be, 3bdi, 3bdo, 3blc, 3bpp, 3bsb, (3bta) 3bva, 3bvl, 3cdk, 3cfc, 3cia, 3cji, 3ckl, 3ds, (3fb), 3fc, 3fs, 3ge, 3gc, 3gs, 3hs, 3lg, 3ll, 3rs, (3tp), 3vw, 3zr, (4ft), 4ia, 4io, 4it, 4jr, 4js, 4ku, 4pv, 4tj, 5agv, 5amh, 5apc, 5in, 6cgw, 9anl, 9anw, 9adp, 9adq, 9afk, 9alb, 9arp, 9ayx, 9bcx, (9bdb), 9bga, 9bhd, 9biw, 9bmk, 9bna, 9bqy, (9bwb), 9cee, 9cii, 9cip, 9cnw, 9csa, 9cwp, 9cxx, 9dbf, 9del, 9dix, 9dlc, 9dlj, 9doe, 9dpx, (9dsa), 9efz, (9eld), 9elb (9em), 9my, 9ny, (9sz), 9vm, 9xbb, 9xbh, 9za, 9zt.

Canadian: 1dd, 2cg, 9av.

8CUD, Toledo, Ohio.

1aei, 1arf, 1bbc, 1bbo, 1bmj, 1bwj, 1ccz, 1cmp, 1om, 1py, 1qm, 1rv, (1vk), 2ah, 2abt, 2aco, 2bkl, 2bta, 2bmr, (2bqb), 2brb, 2byu, 2cgd 2chg, 2ctq, 2cwj, (2cpa), 2fb, 2gc, 2kr, 2ky, 2pd, 2rb, 2ry, 2zm, 3apv, 3avn, 3bay, 3bj, 3bnc, 3ccv, 3ckl, 3cdk, (3cjn), 3cu, 3hz, 3lg, 3oh, 3tf, 3tt, 3uu, 3vh, 3qt, 4af, 4bx, (4dx), 4cy, 4it, (4ft), 4nd, (4oa), 4og, 4py, (4pv), 4rr, 4sb, 4si, 4sh, 4uf, 4xz, 5aek, (5agn), 5agy, 5akn, 5ali, (5apc), 5cn, 5fc, 5ft, 5kr, 5mj, 5nj, 5ru, 5sh, 5ua, 5uy, 5zb, 6awt, 6bwl, (6cgo), 6cgw, 6pl, 7zu, 8dgd, 9cfi, 9dei, 9aea.

North Pole: vdm.

Mexico: ij.

Emil R. Felber, Jr., 9RH
2527 Chestnut St., Milwaukee, Wisconsin.

1abf, 1abp, 1abs, 1afs, 1ah, 1arf, 1azb, 1bgq, 1bmh, 1bsz, 1bym, 1cmx, 2agb, 2baw, 2ctu, 2cxb, 2cxd, 2cxl, 2gf, 3ad, 3adu, 3aoj, 3bco, 3bel, 3bnf, 3brb, 3bu, 3bva, 3bw, 3cdk 3cgc, 3kp, 3pi, 3tb, 3yv, 4bco, 4er, 4lg, 4tw, 5abf, 5ac, 5ajj, 5ce, 5gg, 8aal 8abm, 8adb, 8adk, 8afu, 8ahz, 8ajn, 8alw, 8apn, 8arv, 8atc, 8atp 8avj, 8ay, 8bay, 8bbd, 8bbf, 8bcs, 8bf, 8bfb, 8bit, 8bkh, 8blv, 8bnh, 8bo, 8boy, 8bpa, 8brc, 8bsf, 8bt, 8bvr, 8byd, 8bzf, 8cdc, 8cdi, 8cjo, 8cjp, 8cko, 8cpk, 8cuv, 8cux, 8cwf, 8cwp, 8cwr, 8cxm, 8cys, 8daa, 8dah, 8daw, 8dbo, 8dce, 8dgj, 8dgl, 8dgp, 8dgv, 8dhg, 8diz, 8djf, 8dkb, 8dmf, 8dnk, 8dpo, 8doo, 8gz, 8jg, 8ku, 8rj, 8rm, 8ry, 8vt, 8wo, 8wz, 8zr.

Can.: 2cg, 3he, 3kp.

9ALI, Wyeville, Wisconsin.

1nap, 1abc, 1ajx, 1axn, 1ci, 1fd, 1mo, 1pk, 1arf, 2ady, 2bf, 2brb, 2cee, 2tf, 2wz, 3adq, 3afp, 3bof, 3buy, 3bva, 3bv, 3cbk, 3cjn, 3cws, 3kg, 3pz, 3ov, 3oq, 3lx, 3ws, 3wf, 3xw, 3bc 3zo, 4dk, 4cs, 4do, 4el, 4es, 4ft, 4gc, 4on, 4ot, 5aac, 5aby, 5aj, 5aia, 5aiu, 5akn, 5anp, 5ank, 5amu, 5ath, 5tm, 5akd, 5agz, 5mq, 5bm, 5bt, 5tm, 5fv, 5acn, 5uk, 5ql, 5zk, 5zao, (QRA)? 5ahj, 5vv, 5kc, 5ek, 5za, 5gv, 5io, 5wo, 5ar, 5qy, 5gi, 5pa, 5sg, 5av, 6cgw, 6ol, 6aja, 6kc, 6buo, 6eu, 7eh, 7qc.

Can.: 5aj, 3ds, 3kg.

9APY, Berwyn, Illinois.

1ack, 1arf, 1aww, 1ccz, 1ow, 2bmr, 2cj, (2ctq), 2kf, 2rb, 3acc, 3acr, 3bmr, 3bvl, 3dk, 3lg, 3lm, 3zo, 4gw, 4io, 4ll, 4ab, (5apc), 5nj, 5vk, 5zas, 8aaw, 8acm, (8ajm), 8amd, (8bir), 8blc, 8bam, 8bzf, 8cwb, 8dcc, (8dsn), 8kq, 8sp, 8uf.

All QSL's answered—QRK?

9BFI, Minneapolis, Minn.

1acr, 1awr, 1bis, 1bdx, 1bwj, 1bvr, 1cqm, 1zt, 1zz, 2aar, 2aid, 2ana, 2bmn, 2cga, 2by, 2dc, 2lg, 2ry, 2gk, 3chc, 2bcl, 3agf, 3kg, 4ai, 4dx, 4af, 4hz, 4fg, 4hw, 4mb, 4ot, 4qf, 4zd, 5acl, 5akd, 5ajh, 5aju, 5alj, 5air, 5aiy, 5amh, 5anf, 5apc, 5apo, 5apm, 5arh, 5bq, 5cn, 5ka, 5kr, 5lm, 5nj, 5nt, 5mi, 5oq, 5ls, 5rg, 5sg, 6ajd, 6amo, 6awh, 6awt, 6bbu, 6biw, 6buh, 6chl, 6cct, 6cgw, 6fm, 6vd, 7aiy, 7akk, 7amk, 7co, 7no, 7sf, 7ww, 8abm, 8aeb, 8aee, 8apw, 8axf, 8bjz, 8blr, 8bit, 8bmb, 8bpv, 8bsw, 8cci, 8cko, 8cjd, 8cud, 8ced, 8cur, 8cwu, 8cyi, 8dhs, 8dnk, 8dgl, 8apn, 8zag, 8ab, 8bk, 8nz, 8rj, 8ry, 8tt, 8vw, 8zr.

9CIP, St. Paul, Minn.

(1aac, (1abf), 1aft, 1apj, (1are), (1aur), 1bes, 1bgq, (1bis), 1blx, 1bq, 1bvl, 1bwj, 1cg, 1cgv, 1de, (1my), (1rf), (1sf), 1xam, 1xw, (2adj), (2brb), 2byt, 2eac, (2cqz), (2cu), 2cvu, (2dx, 2gk, 2mu, 2pd, 2xbf, (3adp), 3ajd, 3awa, 3be, 3bpp, (3bvu), (3rs), (3za), 4fs, 4io, 4ku, 4tj, 4xe, (4xx), (4zd), (5ajh), (5ame), 5as, (5dw), 5gk, (5in), (5ot), 5sg, (6nx), 7eo, (8aiq), (8ajn), 8apw, (8avl), (8bnh), (8bpa), 8cmi, 8cnw, (8cql), 8cyi, 8dak, (8dfb), (8dtc), (8gu), (8hn), 8nb, 8wa, 8xc, 8xw, 8zag, (8zf), 9caa, nfv.

Can.: (2cg), 3bg, 4cr, (9av).

TRAFFIC DEPARTMENT

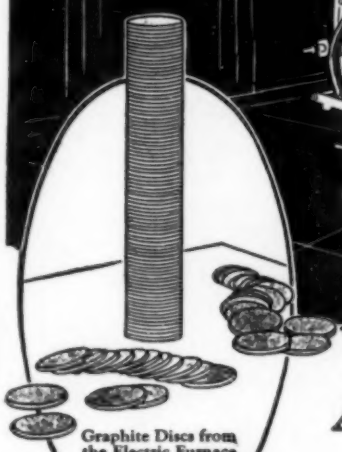
(Concluded from page XII)

and 100 watts under it, should work both ends of the Dominion (that is to say if he is successful in locating that 3rd Harmonic.)

4HH is laughing up his sleeve at the antics of a 5 watt bottle that he stuck in to replace a defunct 50, as the little one seems to be running rings around the bigger one. He is on the air QRV for traffic nightly and will try for schedule with any one wishing for same. 4ER is moving to the basement with his equipment and QRH as well and will be ready in good time for the fall rush. 4BF, 4AO, 4EO and 4AW are on the air occasionally. 4BR (the sine rect. wizard) 4FV and 4AJ are clearing traffic through Regina and a late report gives 4FV the honor of being the first Sask. station to hook up with VDM. (FB, OM!)

MANITOBA—Have you figured out just what those nice new O.R.S. certificates have been issued to you for, gang? Once more we'll say it! It means EVERY possessor of one has given his, or her, word to forward a report of their stations EVERY month, even if the station is out of commission. How about it, gang? Seems like some of us are near-sighted when it comes to reading that "I HERE-BY AGREE."

Producing Graphite Discs in Allen-Bradley Electric Furnaces



Graphite Discs from the Electric Furnace

Allen-Bradley Radio Products are the best insurance against trouble

FINE, stepless control is not the only distinctive feature of Allen-Bradley graphite disc radio devices. It is true that with no other type of rheostat can you enjoy the noiseless, stepless, selective control of the Bradleystat. No adjustable grid leak can equal the Bradleyleak.

But there also is the inherent reliability of the graphite discs, produced in the terrific heat of the electric furnace, and encased in porcelain containers that cannot warp. Atmospheric changes mean nothing to graphite discs. Corrosion cannot destroy them. Continuous use cannot impair their perfect operation.

The slight extra cost of Allen-Bradley radio products is an insignificant premium on insurance against interrupted radio reception. Think this over! The quality endures after the price is forgotten.

Allen-Bradley Co.
Electric Controlling Apparatus

277 Greenfield Ave. — A-B — Milwaukee, Wis.

Manufacturers of Graphite Disc Rheostats for more than 20 years

ALLEN-BRADLEY CO.
277 Greenfield Av.
Milwaukee, Wis.

Please send me descriptive leaflets on Allen-Bradley radio products.

Name.....

Address.....

AMRAD

Read this typical letter!

Kansas City, Mo., Aug. 1, 1924

About 2 yrs ago I bought 2 S-Tubes which you now rate "old style". Have had some wonderful results with these. They are still in use.

You claimed they'd rectify up to 750 V. AC. They sure do and MUCH more. Am sending complete report how I got far more out of them.

Pure DC on straight CW and phone. Reported in Ealing, New Zealand 7500 to 8000 mi from here; WNP, Alaska (3 times) Hamil (6 times); Cuba, 6IT; ship in Panama Canal; 47 states; and all Canadian Districts but one. London, Eng. Any piece of apparatus like the S-Tube deserves more than honorable mention.

Mem. A.R.R.L. C.U.L. Best 73's

Geo K. Shirling

"Ask the Ham Who Owns One"

THE NEW S-TUBE

Co-operating with leading amateurs, we made certain mechanical improvements to the AMRAD S-Tube in order to meet still further amateur requirements for "the Rectifier Without a Filament." These improvements result in:—

1. **Increased mechanical strength**—The internal elements are now so supported that breakage in handling is minimized.
2. **Improved looks**—The shape is now tubular which further facilitates handling as well as improving appearance.
3. **Increased dielectric**—The large Mogul base provides greater dielectric strength resulting in increased efficiency.

Improved production facilities are now materially reducing the existing shortage of S-Tubes. If your dealer cannot supply you, amateurs may send remittance direct to us and we will make promptest possible delivery.

From time to time we have published unsolicited letters from amateurs praising the S-Tube. Many of these refer to the first type. Later, the ratings were increased and even more favorable comments were received. Now, with the mechanical improvements above noted, still greater value is offered to those desiring an economical, dependable, source of d. c. plate supply or for use in charging storage B Batteries.

Send for Bulletin J-2. This describes type 4000 which is identical with new type 4000-1 illustrated, except for the improvements. (New Bulletin is not quite ready).

AMERICAN RADIO AND RESEARCH CORPORATION

Dept. Q, Medford Hillside, Mass.

Dealers in Principal Cities and Towns